The Glass Industry

Copyright, 1923, by Glass Industry Publishing Company, Inc., New York

Vol. 4. SEPTEMBER, 1923 No. 9

Initial Heat Lehrs

By W. S. Mayers*

A Discussion of the Latest Development in Annealing Methods and a Description of an Initial Heat Lehr of the Author's Design

Practically all existing lehr installations have been designed and built in accordance with the theory or supposition that the proper annealing of commercial glass ware is a slow process, requiring from four to ten hours in the heating and cooling stages.

Numerous investigations in recent years, in controversion of this theory, have been made and the fact has been well established that first class commercial annealing can be accomplished in much shorter time periods and with greatly reduced fuel consumption in the production of pressed ware and heavy blown ware, bottles, fruit jars and like articles.

Taken at the instant when leaving the mold, heavy articles of glass contain a much greater number of heat units than at any time during the annealing process and are, in most cases, luminous at this time, even in strong daylight. Any attempt to heat them to the luminous temperature in the lehr will produce distortion or melting down long before this temperature is reached. Why, then, does not distortion take place immediately after the article has left the supporting walls of the mold? The most plausible answer is that although the general mass of the glass is at this time in a plastic or even viscous state, the surfaces have been chilled and hardened to an appreciable depth by contact with the comparatively cold walls of the mold, the hardened surfaces forming a rigid supporting structure for the plastic mass within. On account of heat radiation, the direct contact of the surfaces with the air and the poor heat conductivity of glass, the semi-rigid surface does not become sufficiently softened to cause distortion by gravity, although the articles at this stage may be easily distorted by continued pressure.

After leaving the mold the loss of heat is surprisingly rapid, as indicated by the disappearance of luminosity which takes place generally in a small fraction of a minute, depending upon the thickness of the walls or mass in the piece of ware.

The time consumed in carrying-in from the mold to the lehr chamber, either by hand or by the usual mechanical conveyor is, in nearly all cases, sufficient to cause a drop in the temperature of the ware to a point below the annealing or relaxing temperature, in which case the application of external heat is required.

The rapid cooling of the ware, after leaving the mold, may be arrested either by the direct application of gas flames, or by placing the article in the shortest possible time in a heated and heat insulated container, and upon the latter method the operation of the initial heat lehr depends.

Many have experimented along this line and those who have not may do so in a simple manner. Secure a one-gallon tin pail and place therein a quart can in a central position, filling the space between the two vessels with asbestos fibre or other good heat insulating material. Provide a close fitting cover of several thicknesses of asbestos paper. First, preheat the inner receptacle and the cover by means of a gas jet or by placing them in an ordinary lehr for 15 or 20 minutes. After the preheating is done take a pressed tumbler or packing jar as it comes from the mold, quickly placing it in the receptacle and sealing with the asbestos cover held tight by weights. After a half hour remove the tumbler, which, though much too warm for handling with the bare hands, may be cooled quickly in a jet of air from the fan system.

This tumbler will not be perfectly annealed but if the experiment is properly conducted it will be annealed as well as those which pass through the average lehr and will withstand equal tests with them.

Several years ago the writer built a small experimental lehr consisting of a hand operated slat conveyor about 35 feet long and 6 inches wide and enclosed in a setting made of ordinary gypsum building blocks 3 inches in thickness. The receiving end was made tight and provided with a small gas jet under the conveyor for preheating it to prevent checking and to supply the small amount of make-up heat

*Mechanical Engineer, Monongah Glass Company, Fairmont, W. Va.

to counteract losses by radiation. This lehr was set in close proximity to the pressing machine and the ware was passed through in 45 minutes. Several hundred packing jars were thus annealed and their average in tests proved to be better than that of the ordinary run through the large lehrs with 4½ hours annealing time.

In the time generally consumed in carrying-in by hand, or by open conveyors, the ware cools to a point below the critical temperature range and heavy internal strains are caused before it reaches the hot chamber. In the initial heat lehr it goes in luminously hot, and rapid cooling being prevented, the piece of ware becomes uniformly heated by internal conduction before the lower end of the critical temperature range is reached, the formation of heavy strains being largely prevented.

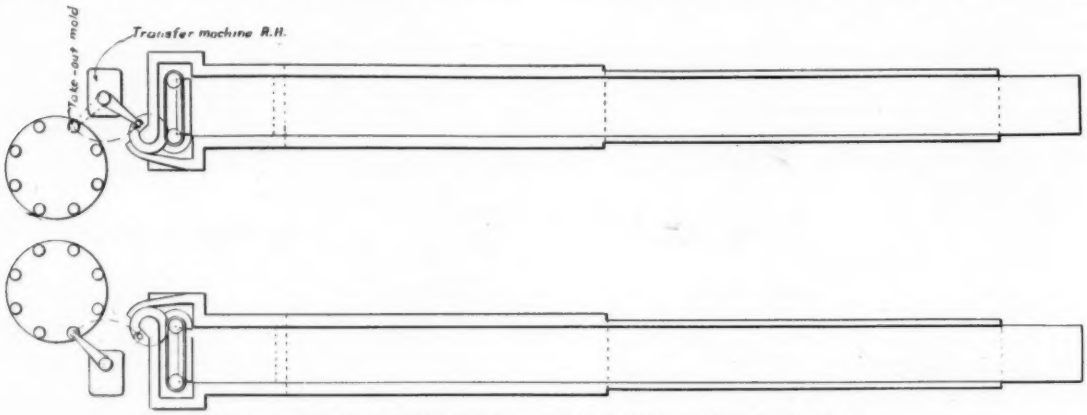


FIG. 1—INITIAL HEAT LEHRS—TYPICAL LAYOUT FOR TWIN PRESS

In this manner the first or heating stage in the annealing process is done away with and it remains only to provide for the gradual cooling of the ware to a temperature somewhat below the critical range.

The annealing temperature depends to a considerable extent upon the weight and composition of the glass and may vary from 900 to 1,100 degrees F., at which temperatures complete relaxation may be said to have taken place. To avoid introducing strains at this stage the cooling must be slow enough to prevent surface chilling and the rate of cooling may be gradually accelerated until a temperature of from 350 to 400 degrees F. is reached, after which the cooling to atmospheric temperature may be hastened by the use of low pressure air jets.

The annealing stage is coincident with the semi-plastic period during the cooling process and there is no well defined dividing line between the plastic and elastic or rigid states. A temperature drop of approximately 75 degrees F. from the upper limit causes sufficient rigidity to prevent deformation, after which the molecular structure is more or less fixed, and the annealing practically accomplished. Too rapid cooling after this stage will fracture the glass and may introduce strains above the allowable limit, but it has been shown by numerous tests that rapid cooling below 400 degrees does not produce strains above the allowable limit in commercial ware.

As the annealing time by the initial heat method is cut down to about one fifth of the time given to the existing type of lehrs, the initial heat lehr requires only about one fifth of the pan area in handling the same production. For example, if an ordinary lehr for handling the output of one forming machine, say 40 pieces per minute, requires a pan surface of 600 square feet, the initial heat lehr will require only 120 square feet and may be conveniently built 36 inches wide inside and 40 feet long. These measurements have been shown to be ample by actual test. For larger production these lehrs may be increased in size proportionally and may be made to handle the output of any forming machine, regardless of its capacity.

In building lehrs of this description the structural difficulties are considerably less than are those in the large lehrs, and as the fire box is omitted in the initial heat type the walls at the receiving end may have, and should have, thick coverings of good heat insulating material, the insulating properties being gradually reduced as the discharge end is approached.

The method is somewhat analogous to that employed in the well known fireless cooker. These cookers are not altogether "fireless," as it is necessary to insert in them hot cast iron plates to retard the rapid transfer of heat to the insulated container. For this same reason, and for the additional reason that the lehr pans must be preheated in order to avoid checking the incoming ware, it is necessary to place a small gas burner within the receiving end of the lehr. The gas consumption in these small burners, however, is but a small fraction of that required for the present large lehrs, especially those of the muffled type.

The construction of the small lehr to give the proper heat gradations presents no special difficulties and is, in general, a matter of location and size of the preheat burner, location and size of vents in the hot end and the thickness of walls. In the opinion of the writer a 2-inch refractory lining in the hot end covered with from 4 inches to 6 inches silocel or nonpareil insulating walls with gradual reduction in thickness, and bound in place by structural steel frame work, is superior to any other.

The pan conveyor should be of the endless uniform speed type and the present well known constructions of double chains carrying thin channel shaped bars, reduced in section and weight to correspond with the reduced size of the lehr, probably cannot be much improved upon. Along this

line suggestions have been made embracing the use of reinforced asbestos belts, woven wire belts and a series of small steel link chains, but these, in the opinion of the writer, while having some advantages, have disadvantages sufficient in weight to preclude their use.

In initial heat annealing it is of prime importance that the ware be transferred from the mold to the lehr chamber with a minimum amount of cooling and this requires either a uniformly hot insulated carrying-in conveyor or the placing of the hot end of the lehr within two or three feet from the take-out mold. When the latter method is practicable, as it generally is with some rearrangements, it is much to be preferred both from the first cost and operating standpoints, and the reduced lengths of these lehrs make large floor spaces available for other purposes.

Fig. 1 is a scale drawing showing what is believed to be the best location for these lehrs in connection with a well known twin press for making tumblers, each lehr taking the output from one press table. On account of the narrow space limits between the tables, this layout is chosen as the one which probably presents maximum difficulties in the matter of installation. For transferring the tumblers or bottles from the mold to the lehr an automatic transfer machine of simple construction has been developed, the location and general outline of which is shown in the drawing.

In order to illustrate ways and means for the practical carrying out of the initial heat annealing method, as far as possible within the prescribed limits of this paper, Figs. 2 and 3, showing vertical and horizontal sections through a lehr of this class, are presented, these being modified drawings made from those in the application for patent, now pending.

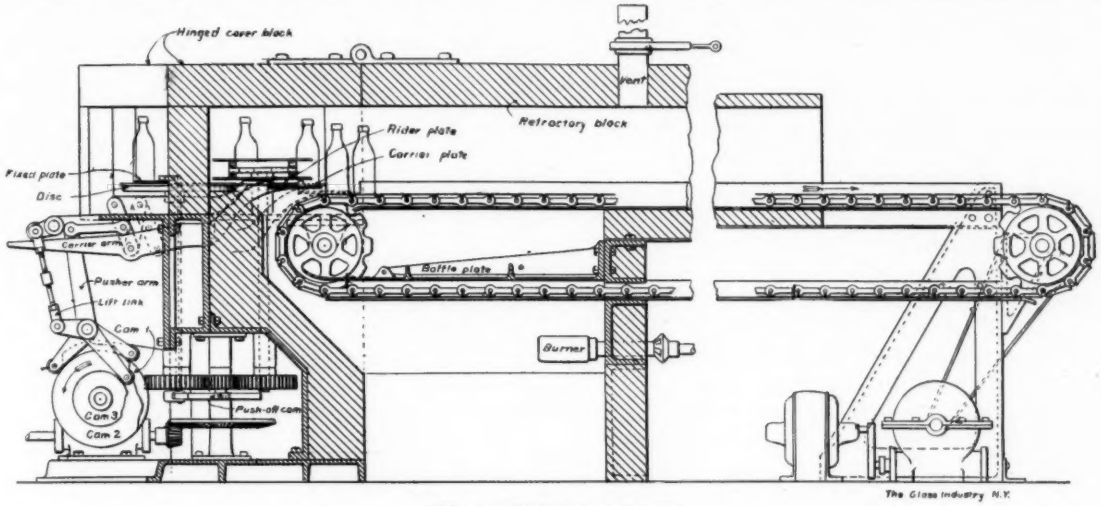


FIG. 2—VERTICAL SECTION

Referring to Fig. 2 it will be noted that the lehr feeding mechanism consists essentially of a revolving transfer disc upon which the bottles are placed by the transfer machine, not shown, and a cross conveyor with projecting arms for engaging the bottles delivered by the disc and sliding them across the lehr upon a periodically advancing and receding thin carrier-plate in working relation with a rider or push-off plate as shown.

These plates are actuated by a system of levers, links and cams and their operation is almost identical with that of

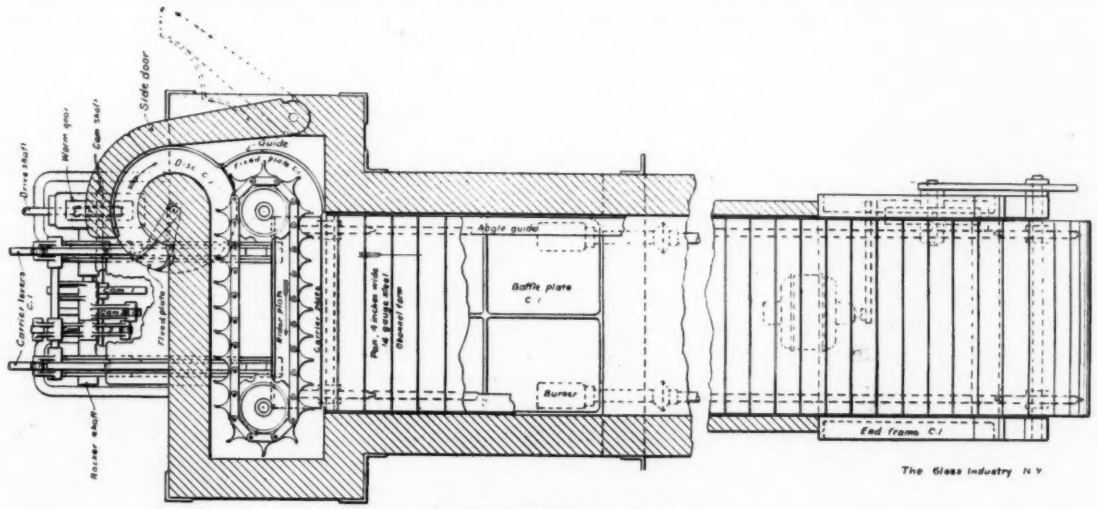


FIG. 3—HORIZONTAL SECTION

the well known carrying-in by hand on "bucks." When a complete transverse row of bottles is deposited on the lower plate by the conveyor the two plates are advanced several inches, as shown by the dotted lines in Fig. 2, the lower plate meanwhile dropping to the level of the conveyor pans, and the upper plate being in position to receive the incoming ware. In the next movement the lower plate recedes to its starting position, still on the lehr pan level, and the row of bottles, being held stationary by the upper plate, drop without danger of upsetting upon the lehr pans. In the succeeding cycles of operation the lower plate rises to its original position and finally the upper plate recedes to its original position, dropping the two or three bottles, which it received during the operation, to the lower plate.

The drive shaft of the lehr, and that of the transfer machine, are directly coupled and geared to a shaft on the machine press, so that all are properly timed and in synchronism.

Two gas burners are shown in heating relation to the lower run of the lehr pans and located directly under the chains in order that the heavier parts comprising the chains may be properly preheated. The baffle plate prevents the short circuiting of the hot gases upward through the pans, the gases passing through the throat under the cross conveyor and then escaping through the vents, of which there may be several at different points.

The opening of the side door and hinged cover block provides easy access to the interior lehr mechanism.

The details of the feeding and transfer mechanism, above briefly described, have been worked up to the point where a commercially practical and operative installation can be made. It is obvious, however, that other mechanical designs may be worked out to produce the same results and the field is an attractive one.

In regard to the first cost of these lehrs as compared with the present types with automatic carrying-in conveyors and lehr feeders, the initial heat type can be constructed and installed at a cost which will leave a large balance in its favor, at the same time reducing the maintenance costs.

If it should become necessary to use producer gas in these small lehrs it would be necessary to muffle the heating chamber to prevent sulphuring the ware. As the amount of heat is so small, however, it is reasonable to predict that natural gas for this purpose will be procurable for many years to come, and when it is no longer available refined manufactured gas or fuel oil may be substituted at reasonable cost.

Glass Grinding Fixtures

By B. W. Barish

In this article I describe a few characteristic operations in connection with glass grinding which make for more convenient and efficient work.

Grinding Lenses to Gauge

For grinding lenses to gauge the fixture shown at Fig. 1 is used. Bracket A can be adjusted by means of screw B.

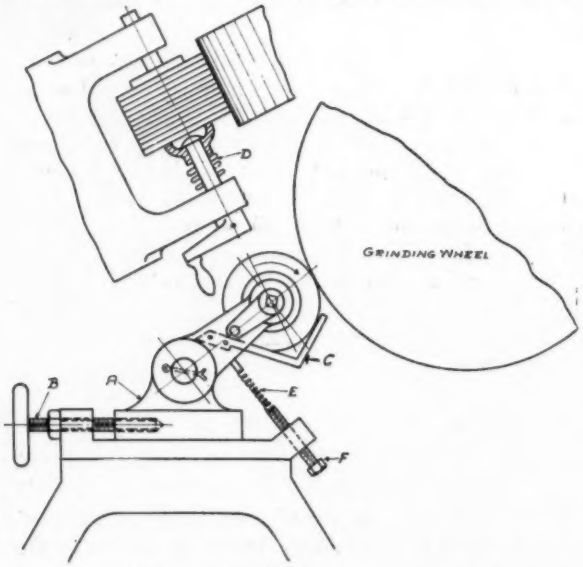


FIG. 1

The lenses are placed between the clamping jaws and are centered by means of angle C (not shown in top view).

D is a clamping spring. E is a tension spring. Increasing or decreasing the tension of spring E by means of screw F, regulates the friction between the lenses and the grinding wheel.

Grinding lenses to gauge requires careful and skilful attention.

Cutting Holes in "Bullet-Proof" Glass

For cutting holes in bullet-proof glass (bullet-proof safety glass is made of two sheets of glass with a sheet of pyralin in between, and is about one inch thick), a cylinder made of

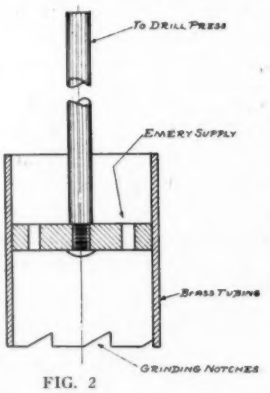


FIG. 2

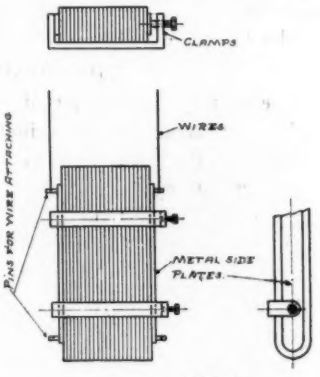


FIG. 3

brass tubing is employed, with notches at the grinding end for more effective work. (See Fig. 2.)

Rounding Ends of Rectangular Bars

Instead of grinding the bars individually, the rigging shown at Fig. 3 is used. This rigging is suspended from the ceiling by wires. After the rounding of one end of the bars is completed the fixture is reversed and the other end put through the same operations.

Recuperation and Heat Recovery

By E. R. Posnack*

The Advantages and Disadvantages of Recuperation Compared with Other Methods of Conserving Waste Heat

American engineering skill and ingenuity has been successfully applied to so many branches of our manufacturing enterprises, that it is indeed strange it should not have been directed more seriously to that important division of our industries that concerns the design, construction, and operation of industrial furnaces. Where every conceivable source of information has been tapped to improve and economize production in the machine departments of our plants by the installation of intricate machinery and ingenious cost and production systems, it is not an uncommon thing to see steel heat treating or glass melting furnaces in operation with flames shooting out of the stacks, doors and crevices, and heat needlessly radiating out in all directions, thus offsetting, and perhaps overbalancing the economies effected in other departments, not to speak of the intolerable conditions thrust upon the workmen, nor to mention the unevenly-heated and inferior products resulting from haphazard furnace design.

While insulation, flue design, hearth construction, heat application, and structural details are, among others, some of the important matters to be considered in furnace design, these are problems that many of our furnace engineering firms are now beginning to take up from a scientific standpoint in preference to the old "bricklayer" methods, and hence will not be elaborated upon here. What concerns us is the problem of conserving waste heat by recuperation, a subject comparatively new in this country but one that is now springing into prominence. Although here it is in its initial stages, recuperation has been extensively used in Europe for the past twenty years, because the fuel situation there has, until the present time, been a more serious problem than in the United States.

The Object of Recuperation

Briefly, the prime object of recuperation is to conserve fuel by extracting, in a continuous operation, as much as possible of the waste heat in the stack gases to preheat either the air required for combustion or the gasified fuel, or both, thereby throwing back into the furnace the large quantities of heat that are generally lost through the stack. Inasmuch as the preheating of the gaseous fuel is beset with many difficulties, such as the disintegration of the hydrocarbons at high temperatures, and other practical difficulties, it is a method very seldom used, and therefore will not be treated here.

The heat transfer from gas to air is accomplished by having the products of combustion, after doing the required work, pass through a series of flues that are contiguous but entirely independent and separated from another set of flues through which the air required for combustion is passed on its way to the combustion chamber. As the air is injected at atmospheric temperatures and the gases at furnace temperatures, it is evident that the heat of the gases will raise the temperature of the incoming air, so that the B.t.u.'s which would ordinarily pass out through the stack are reverted into the furnace and made to do useful work again.

Theoretically it would be desirable for the outgoing gases to heat the air to furnace temperatures—something impossible of attainment due to practical considerations. However, in a well-designed recuperator where there is sufficient surface for heat transmission between the air and gas, the air should be heated to a temperature approaching that of the furnace—a conservative figure being 1,500 deg. F. for furnace temperatures of 1,800 deg. F., or 2,000 deg. F., for furnace temperatures of 2,400 deg. F.—results that have actually been obtained in practice.

Savings Due to Recuperation

Taking into consideration these high air temperatures, and bearing in mind the large quantities of air required by various fuels for combustion, such as 1,300 cubic feet of air per gallon of fuel oil, 10 cubic feet of air to every cubic foot of natural gas, 6 cubic feet of air per cubic foot of illuminating gas, it becomes very evident that large savings are possible.

An example will serve to illustrate this point. Let us consider fuel oil of 144,000 B.t.u. per gallon, requiring about 1,300 cubic feet of cold air for combustion. Assuming all the air for both combustion and vaporization to be preheated to 1,800 deg. F., the specific weight of the cold air to be .08, and the specific heat of the air to be .17,—a low mean value,—the amount of heat thrown back into the working chamber will be $1{,}300 \times .08 \times .17 \times 1{,}800 = 32{,}800$ B.t.u., approximately, for every gallon of oil used.

The thermal efficiencies of industrial furnaces not utilizing waste heat are very low, ranging from 5 per cent to about 25 per cent as a rule, pot glass melting furnaces being less efficient than tank melting or steel heating furnaces. Let us, however, take a 20 per cent efficient furnace as an example, that is, one in which 20 per cent of the heating value of the fuel is utilized in heating or melting the product. Then each gallon of oil yields only $.20 \times 144{,}000 = 28{,}800$ B.t.u. for useful work—the remaining 115,200 B.t.u. being lost through the stack, heating the furnace walls, radiation, etc. Of this, there can be recovered about 32,000 B.t.u. by preheating of the air, as shown above, or more than each gallon of oil affords for useful work. The savings from this source now become quite apparent.

Elimination of Excess Air

This illustrates merely one of several ways in which recuperation decreases fuel bills. Another is that due to the elimination of excess air for combustion. Everyone knows that under ordinary circumstances the theoretical amount of air required for combustion is but a fraction of that actually used in practice, because not all of the air injected into the furnace combines with the fuel, which, to be completely con-

* Mechanical Engineer, New York.

sumed, requires additional quantities of air. This excess air carries with it 80 per cent of inert nitrogen which absorbs considerable heat that should be applied to the product, thus causing an unnecessary loss of no little account.

That recuperation obviates the use of excess air and avoids this loss, is an established fact. There are several contributing factors bringing about this result, the most important of which are probably these:

1. There is greater molecular activity in hot air than in cold air, hence the mixing with the gases is more thorough.

2. Heated air is less dense than cold air, so that the air molecules are further apart, and a thorough mixing is made possible.

3. The contact of hot air and comparatively cold fuel gas in the combustion chamber causes the contraction of the air and the expansion of the gas. As both air and gas are confined to a space of constant volume, this contraction of the one and expansion of the other will cause a thorough mixture.

PREVENTION OF OXIDATION LOSSES

By avoiding the use of excess air not only is fuel saved, but it is possible thereby to obtain a neutral atmosphere in the furnace. This is especially desirable in those cases where exposed surfaces of the product are subject to oxidation, as in non-ferrous melting and steel heating furnaces, with resulting scaling and evaporation losses.

OTHER ADVANTAGES

Preheating of the air not only reduces fuel consumption but it also increases production and improves the quality of the product. It is evident that the temperature of combustion varies directly with the temperature of the combustion air. Experience teaches that the temperatures of combustion with preheated air never reach the theoretical values, but due to various factors such as the relative amounts of combustibles, inerts, moisture, and other constituents of the fuel, aided by varying atmospheric pressures and other conditions, combustion is retarded and partly reversed at certain temperatures. This causes solid particles of carbon to appear, which, together with other combustibles, burns with a large high-temperature luminous flame. Due to the luminosity of the flame, radiant energy emanates therefrom, propagating heat at an enormous rate. Thus the product is heated in less time, and the furnace capacity is increased.

Besides, radiant heat is most desirable in furnace operation, as is generally admitted, because it produces an evenly and thoroughly heated product, due to its penetrating qualities.

Another use for recuperation should not be overlooked—that of rendering practicable the use of fuels of low calorific values for high temperature work. Without highly preheated air, producer gas of say 150 B.t.u. per cubic feet could never be used in glass melting or forge furnaces where the working temperatures are in the vicinity of 2,400 deg. F.

OTHER METHODS OF CONSERVING WASTE HEAT

There are two other well-known methods of conserving waste heat—by the regenerator and the waste heat boiler. The principles of regeneration are too well known to require a detailed description. Through each of two distinct sets of checker work, the waste gases and the combustion air, respectively, are passed, and by means of the periodic operation of a reversing valve, the paths of the air and gas are interchanged, causing the air to absorb the heat stored in the checker work by the gases which had previously passed through it. It is plain, then, that the object of regeneration is the same as that of recuperation, namely, to preheat the air required for combustion.

While there are some cases, as in the large open-hearth furnaces, where regeneration is more practicable than recuperation in the present stage of its development, there is no question but that in the majority of cases regeneration can be advantageously replaced by efficient methods of recuperation. It is the contention of the writer that recuperation is as great a step ahead of regeneration, as regenerative installations are over the old direct-to-the-stack furnaces.

ADVANTAGES OF RECUPERATION OVER REGENERATION

The most outstanding advantage of recuperation over regeneration is the elimination of the human element necessary in the operation of a regenerator. The labor cost, and the serious and ever-present danger of forgetfulness in reversing, or the additional cost of an expensive automatic reversing valve, are dispensed with in the continuous recuperator.

Most reversing valves are so constructed that the inevitable accumulation of particles of soot prevents complete closing of these valves, so that there is a constant leakage of air or gas. This, supplemented by the short-circuiting of the gases through the stack at the instant of reversing, results in an appreciable loss.

Another characteristic fault of regeneration is the resultant fluctuating furnace temperatures. Where periodic reversals are necessary, the air passing through the checker work at the beginning of the period is at a higher temperature than at the end of the period when a good portion of the heat stored in the checker work has been abstracted. Constant temperatures in the working compartment of the furnace are therefore impossible of attainment—thus impairing the quality of the product. Complete elimination of these fluctuations is impossible, but they can be reduced by greatly increasing the size of the checker work, which means an increased expense, and a cumbersome, space-consuming design.

A well-designed recuperator will generally last from six to ten years, thus outliving a regenerator by a considerable margin. This is due to the fact that the recuperator walls never reach the temperature attained by the checker brick of a regenerator, where the hot gases pass through without the simultaneous counter-influence of the heat-absorbing air. Naturally, high temperatures are not conducive to long life of refractories. Furthermore, in open tank furnaces, where the products of combustion carry over some of the caustic ingredients of the molten product, the checker work, under the extremely high temperatures it is heated to, usually becomes subject to the chemical influence of these ingredients, with deteriorating effects—a state of affairs familiar to most glass furnace men. The lower mean temperatures of the recuperator walls render them less liable to this action.

Another consideration is the small floor space required by a recuperator in comparison with a regenerator. Whereas in one the air and gas course through at the same time, in

the other two distinct sets of checker work are required, one for the air, and the other for the gas, thus taking up considerable space.

Finally, just as the principle of the direct transmission of heat from fluid to fluid is employed in the economizer, the superheater, and practically every other heat-transfer apparatus, so is it logical from an engineering standpoint to give preference to a thin-walled recuperator with the direct transmission of heat from gas to air, than to a massive regenerator with an indirect method of heat transmission.

THE WASTE-HEAT BOILER

As to the waste-heat boiler, the field of application is comparatively limited. As these boilers are hard to start, and take time in getting up steam, it is evident that they can only be used with continuous furnaces where the heating cycle is constant, as fluctuating waste gas temperatures are as undesirable in waste heat boilers as varying furnace temperatures are in ordinary boiler practice. A combination of several furnaces discharging their products of combustion into one waste-heat boiler would improve matters considerably, but would not entirely obviate fluctuating temperatures, and besides, would increase the precautions to be observed in such a combination. It is also necessary to design such boilers with a greater amount of heating surface than is required in standard boiler practice, thus adding to the cost of a normally intricate and expensive installation.

Where powdered coal is used, waste-boilers are more satisfactory than either recuperators or regenerators, as the ash dust in the coal would tend to clog up the passages in the air-preheating devices. It is also preferable in direct-fired furnaces, where the coal is fired on the grate, as preheated air, combining with the coal, would fuse the ash and melt the grate. However, recuperation can easily be applied to coal-fired furnaces by firing into an in-built or integral producer, where the fuel is gasified by introducing 50 per cent of the required air for complete combustion underneath the grate, and injecting the remaining 50 per cent of the air, preheated, into the combustion chamber to combine with the gasified fuel. Such installations are extensively used.

OTHER METHODS

There are other methods of conserving fuel in industrial furnaces, such as the use of preheating chambers for utilizing some of the combustion gases to heat the stock prior to its entry into the main working chamber, or the preheating of air by passing it along the walls of the furnace. These will not be discussed here, as they rightfully belong under the subject of furnace design, not being independent heat recovery units; and besides, they only utilize a fraction of the available waste heat.

With all these considerations in view, it is logical to ask why there are so few recuperative installations in this country. With thousands of recuperators throughout Europe, and with so many outstanding, indisputable merits that make most of our present furnaces seem obsolete, why is it that American manufacturers, with an eye to economy, have overlooked, or failed to take advantage of a simple and tried method of increasing their earnings?

One reason is that many were unaware of the advantages of recuperation, as there has been little educational work done in this direction, and they are consequently reluctant to accept so-called "new-fangled" ideas. Then, as already explained, the price of fuel here did not, until the present time, warrant the outlay of money for heat-recovery methods. However, there are some genuine good reasons why many of our practical manufacturers objected to recuperation—primarily because of several serious defects inherent in most designs. These faults kept them out of this country, but had to be overlooked and put up with by Europeans in their urgent need for the reduction of fuel consumption.

(*Part II will appear in the October number*)

Electrification of the Allegheny Plate Glass Company*

By G. P. Wilson†

(*Concluded from the August Number*)

The two sections controlling the two speed sets are duplicate. Each top portion is equipped with a controller having one green and two red indicating lamps. This controller is used for closing the starting and running circuit breaker of the motor generator set. A second controller operates the motor operated rheostat in the shunt field of the direct-current generator. A third controller operates the solenoid operated carbon breaker connecting the generator to the direct-current end of the synchronous converter. The meter portions of the sections are each equipped with a double reading indicating wattmeter for reading the input or power pumped back into the line from the alternating-current machine of the motor-generator set. A voltmeter and ammeter with double scales are provided for reading voltages and current delivered or consumed by the direct-current machine of the motor generator set and two watthour meters with ratchet attachment, one for reading the input to the set, and the other the power pumped back into the line. Mounted on each of the front sections are the overload and low voltage relays for the protection of the alternating-current end of the motor-generator set and current and potential testing links for calibrating the meters.

The motors which drive the grinders and the two speed sets are located in a room approximately 350 ft. long by 15 ft. wide, directly back of the grinders. A balcony extends the entire length and width of the motor room above the machines and is completely enclosed on two sides with glass. The eight contactor boards, each consisting of three 90 in. high panels with the primary oil circuit-breaker mounted on pipe structure with disconnecting switches, instrument transformers, etc., are located in this balcony. These boards, with the oil circuit-breaker pipe structure in the rear and braced thereto, are mounted directly above the motors. Two of the boards contain a panel and oil circuit breaker starting equipment for the control of the speed sets.

*The Electric Journal, Vol. XX, No. 4, April, 1923.
†Switchboard Engineer, Westinghouse Electric & Mfg. Company.

A section of this motor room and balcony is shown in Fig. 5. The machine in front is the synchronous converter used with the speed set to obtain adjustable speed on the grinder motor which is directly back of this machine. The oil circuit-breaker pipe structure and contactor board that control these machines are seen mounted in the balcony directly above the motor. Fig. 6 shows three of the contactor boards and pipe structure installed. Nine busses made of 1.25 and 0.75 in. iron pipe size copper tubing run the entire length of this switching room. These busses are supported to the roof girder every 4.5 feet, by 7,500 volt pillar type porcelain insulators. Three of the busses are the three-phase, 2,300 volt, 60 cycle main power lines, fed by three 500,000 circ. mil cables, running directly from the main substation. The other six conductors form the two speed set busses. They are connected to two sets of contacts on each of the control boards, which serve to connect the secondary of the motors to either of the sets. The remainder of the contactors on the board are used in starting the grinder motors. Three of them are resistance short-circuiting contactors that cut out portions of the resistance as the motor accelerates, and the four short-circuits the resistance entirely when the motor has reached synchronous speed.

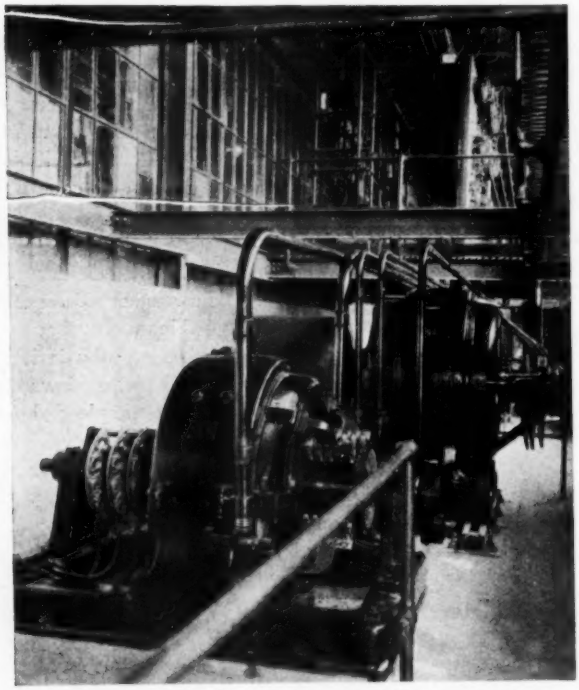


FIG. 5—SECTION OF GRINDER MOTOR ROOM AND BALCONY
One of the synchronous converters used with the speed sets is shown in the foreground.

Motor-operated drum control switches play an important part in the safe operation of the set and the motor. Two of these drum switches are supplied for each motor to take care of placing the motor on either of the speed sets. Through the switch contacts are carried the principal interlocking wires and connections. This prevents the operation of any contactor or switch until the proper set-up of all auxiliary contacts on the various pieces of apparatus has been made by the safe operating position of the various pieces. Not until the above condition has been fulfilled will the control switch revolve. It revolves only three-fourths of a revolution, but in this travel it changes the set-up of the contactor so that the main grinder motor is transferred from secondary short-circuit conditions to its secondary operating through the speed set or vice versa. In addition it cuts off its own actuating motor circuit, makes contact for the reverse direction of rotation of this motor and sets up an interlocking circuit that prevents any other grinder motor being placed on the speed set. By referring to the schematic diagram in Fig. 3 it will be easy to understand the purpose and function which the switch performs.

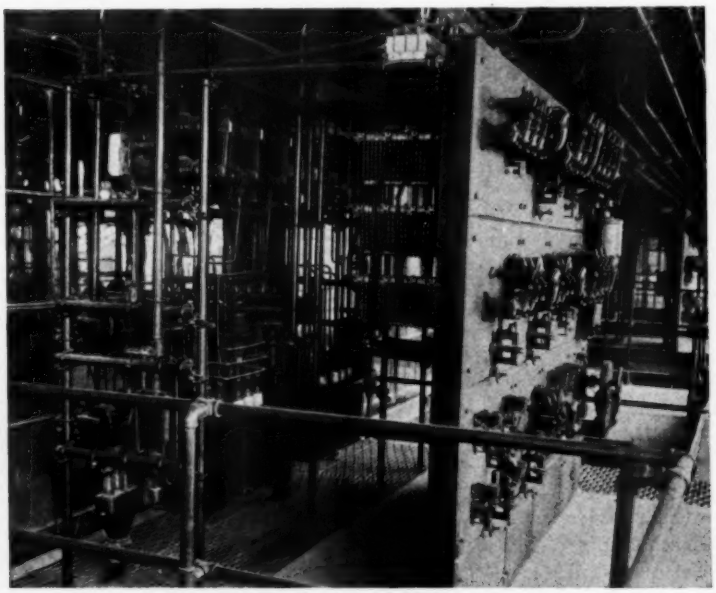


FIG. 6—INSTALLATION OF CONTACTOR BOARDS

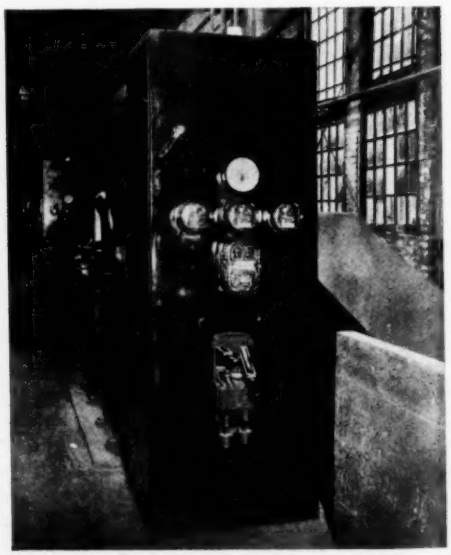


FIG. 7—FRONT VIEW OF MOTOR CONTROL CUBICLE MOUNTED ADJACENT TO THE MOTOR WHICH IT CONTROLS

Due to the flood stage of the river on whose bank this

plant is located, it was necessary to make all the main connections to the motors and speed sets with lead covered cable run in iron conduit supported on the floor beams of the balcony on which the switching equipment is located. All of these cables were provided with potheads which makes all connections as near moisture and waterproof as possible. The control wires used for making connections between the main control board and the switching equipment are multiple conductor cables. These cables are run in 1.25 in. conduit supported from the roof girders of the main building. The signal lighting circuits are mostly of single conductor rubber insulated weatherproof cable.

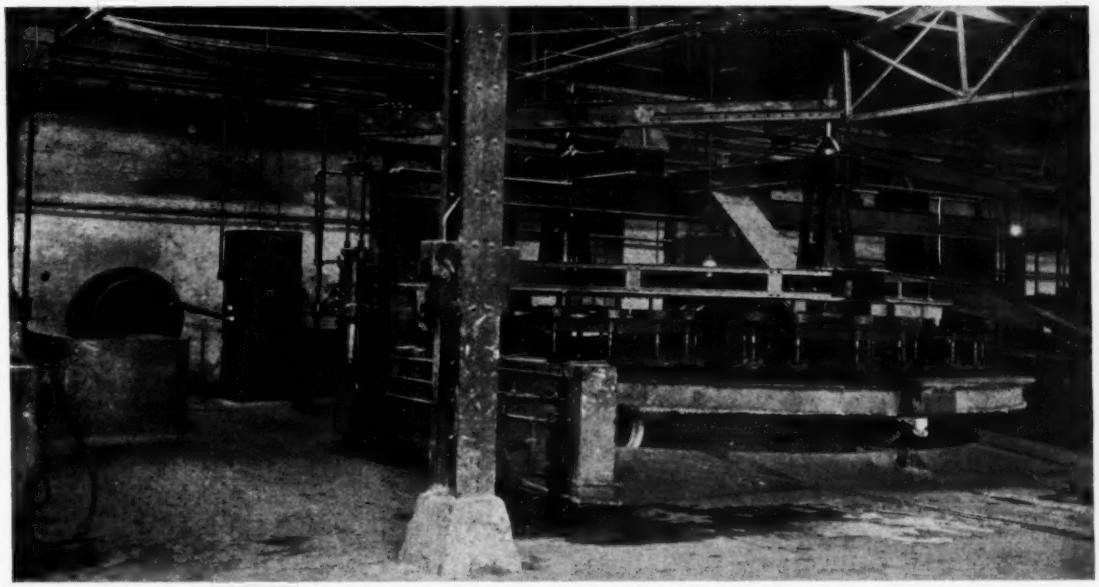


FIG. 8—POLISHING MACHINE WITH DRIVING MOTOR AND CONTROL CUBICLE SHOWN IN THE BACKGROUND

The polishing machines are belt driven by 400 hp., three-phase 60 cycle constant speed squirrel-cage motors, located near the polishing machines and on the same floor as the polishing table. Inasmuch as they are constant speed machines, the motors do not require an elaborate switching scheme, such as just described for the grinding equipment. The control is unique, however, in its design but admirably fitted for the service required. It is of the standard two-voltage type, using autotransformers for obtaining the starting voltage. The starting switch is a standard manually operated, single unit oil circuit breaker starting switch having mechanical sequence interlock for the starting and running handles. In addition to the alternating-current low-voltage and overload relays, the breaker is equipped with a direct-current low-voltage device that trips the breaker on failure of the control voltage. Disconnecting switches are provided on the incoming power leads of the starting switch. The entire control equipment, including the autotransformer, is enclosed in a steel box or cubicle. The three-pole disconnecting switch, which is mounted in a separate compartment at the top of the cubicle, is operated by means of a handle located on the front and outside. The cubicle is provided with two doors, one on each side, to obtain more accessibility when inspecting or removing the apparatus. Especially was this feature desired in this installation, on account of the frequent removal of the circuit breaker tank for inspection of contacts and the renewal of oil and arcing tips necessitated by the extremely hard service. This equipment is started and stopped on an average of eighteen times every twenty-four hours. A specially designed interlocking feature is provided which prevents the opening of either door unless first the oil circuit breaker and then the three-pole disconnecting switch is opened. The rear is bolted solidly to the frame with provision made in it for the outgoing leads to the motor winding. The incoming leads brought in the top are provided with entrance bushings. The disconnecting switch compartment is entirely enclosed, even when the cubicle main doors are opened. This makes it impossible for an attendant to come in contact with live parts while working in the oil circuit breaker and instrument transformer compartment.

These steel cubicles are located near each motor as shown in Figs 7 and 8. This location was selected so as to provide for the convenience of the polishing machine operator in starting and stopping an equipment and also to obtain a short run for the connections between the starting equipment and the motor.

This plant receives its electrical power from the West Penn Power Co., through two direct lines from the Springdale Power Plant into the customer's outdoor substation shown in Fig. 9. The power comes in at 22,000 volts and is carried through the substation switching equipment to a 5,000 kv-a bank of transformers, where it is stepped down to 2,300 volts. The lines are each equipped with an electrically operated outdoor mounted oil circuit breaker. These are interlocked to prevent both being closed at the same time, and are equipped with overload relays and low-voltage protection. Disconnecting switches, choke coils and lightning arresters are provided for each incoming line. A set of metering equipment is connected behind the circuit breakers and measures the total power input to the transformer bank. The transformer bank is arranged for operating either open or

closed delta, disconnecting switches being provided for cutting out any one of the transformer units.

The low-tension side of the transformer bank feeds in through disconnecting switches to the main substation bus. This main substation is equipped with two 750 kw synchronous motor-generator sets, furnishing 250 volts direct-current; one 300 kw., 250 volt direct-current engine driven generator; one air compressor driven by a 200 hp., 2,300 volt synchronous motor; and a main switchboard and oil circuit breaker structure.

This plant has recently been purchased by Mr. Henry Ford, and is now under his management and supervision. We have every reason to believe that the completeness with which this plant was electrified played an important part in Mr. Ford's decision to take over this plant rather than some other of the great many independent glass plants in this district or other parts of the country.

This plant has been operated electrically about eighteen months and during that time they have at all times been able to more than double the output of the plant which, before electrification, had several more grinder and polishing machines than are now being utilized. The maximum output of the plant, we believe, has not yet been reached. It will be of interest to follow its operation under Mr. Ford's management, as we feel sure that the plant is capable of turning out more glass than any plant of its size in this district.

The Testing of Glass for Practical Use*

By Dr. Friedrich Spaete†

Whoever is, or has been engaged in glass manufacturing, has made the observation that glass makers and factory managers often know very little about the properties which the glasses possess that are made by them. How often changes are made in a batch, because the glass produced does not prove satisfactory for its purpose! Glass which is worked by hand is made from a batch different from that used for glass ware made by machinery. In the same furnace glasses are made for the most diverse purposes from a variety of batches. No reference is made here to colored glasses; their manufacture justifies the use of different batches.

If the question is put why so many different batches are melted, in what respect the glasses made from the various batches are different, the answer in most cases is unsatisfactory. Usually it is considered sufficient to make the glass harder or softer for certain uses—that is more or less difficult to melt. Just as little is known about the annealing temperatures of the glasses made, *i.e.*, the required temperature of the receiving end of the lehr, the lowest temperature needed to obtain the glasses free from strain through slow cooling. All these facts are little known among practical workers and yet, at the present state of development of glass science it is possible to determine many properties of importance to manufacturers through simple tests. It is possible to determine many properties of glasses before they are made, before the finished product is at hand and available for examination. These properties can be determined approximately from the calculated chemical composition.

In the following a number of methods are given, by means of which glass can be tested as to its working qualities and fitness for practical use. These methods are mostly not new, but are simplified by the author and tried out for practical application. It amounts to a collection of practical methods which are scattered through the literature. It will be shown to what extent the testing of glass is feasible and how glass can be judged according to its chemical composition and physical properties. Naturally this review cannot be exhaustive and only the most important tests can be outlined. No mention will be made of the special properties of optical and scientific glasses.

*From *Glastechnische Berichte*, published by the German Society of Glass Technology. Translated by J. B. KRAK, Technical Editor of THE GLASS INDUSTRY.

†Director of Research, Osram Works, Berlin.

The methods of chemical analysis are considered to be known. The chemical composition of a glass is always an important factor in judging its properties. However with a knowledge of the chemical composition the importance of chemistry for glass science and glass technology ends. Of course chemistry is important for the testing of raw materials and the calculation of the batch composition. The chemistry of glass is of importance since the physical properties are functions of the chemical composition. In the finished glass the most interesting features, aside from the chemical resistance, are the physical properties. They can be derived from the chemical composition according to the following formulae which are taken chiefly from Hovestadt's "Jenaer Glas"[1] Chapter VII.

The physical properties of glass depend also on the physical condition in which glass exists, that is, it can be free of strain or in a strained condition, it can be amorphous, cryptocrystalline or microcrystalline. These phases of the subject cannot be discussed here.

a. SPECIFIC GRAVITY (Density). It is calculated according to the following formula:

$$\frac{a_1}{z_1} + \frac{a_2}{z_2} + \frac{a_3}{z_3} + \ldots = \frac{100}{S}$$

in which a_1, a_2, a_3, are the percentages of the corresponding oxides in the glass, z_1, z_2, z_3, the specific gravities with which these oxides occur in the glass, and S the specific gravity of the glass itself. The values for z are as follows:

SiO_2	2.3	PbO	9.6	As_2O_3	4.1	K_2O	2.8
B_2O_3	1.9	MgO	3.8	BaO	7.0	CaO	3.3
Zn O	5.9	Al_2O_3	4.1	Na_2O	2.6	P_2O_5	2.55

These figures are the factors established by Winkelmann and Schott. They have been tested by English and American investigators, and new factors have been proposed by W. L. Baillie[2] and S. English and W. E. S. Turner[3].

The values are as follows, and show very good agreement between the experimental and calculated densities:

[1]Published by Gustav Fisher, Jena, 1900. English translation by J. D. Everett and A. Everett, London, 1902.—EDITOR.

[2]Journal Soc. Chem. Ind. 1921, Vol. 40, p. 141.

[3]Journal Soc. Glass Techn. 1922, Vol. VI, p. 228. [Compare also Tillotson, J. Ind. & Eng. Chem. Vol. IV, p. 820 (Nov., 1912).—EDITOR.]

$$\frac{a}{A} + \frac{b}{B} + \frac{c}{C} + \ldots = \frac{S}{X}$$

in which a, b, c . . . are the percentages of the oxides in glass, S the sum of the constituents by analysis, A, B, C . . . the specific gravities of the oxides. The values for A, B, C are:

	Baillie	English & Turner		Baillie	English & Turner
SiO_2	2.24	2.20	Sb_2O_4	3.00	
B_2O_3	2.90		K_2O	3.20	
Zn O	5.94		BaO	7.20	
PbO	10.30		CaO	4.30	5.00
Al_2O_3	2.75	2.75	Na_2O	3.20	3.47
As_2O_5	3.33		MgO	3.25	3.38
			MgO in absence of alkalies ..	4.30	

b. TENSILE STRENGTH. It is calculated as follows:

$$P = a_1 y_1 + a_2 y_2 + a_3 y_3 + \ldots$$

in which P is the tensile strength, a the percentages of oxides and y the corresponding tensile strength factors. They are:

SiO_2 ..	0.09	PbO....	0.025	As_2O_5..	0.03	K_2O ...	0.01
B_2O_3 ..	0.065	MgO...	0.01	BaO ...	0.05	CaO ..	0.20
ZnO ..	0.15	Al_2O_3..	0.05	Na_2O ..	0.02	P_2O_5 ...	0.075

c. COMPRESSIBILITY. The calculation is done similarly, according to the formula:

$$R = a_1 y_1 + a_2 y_2 + a_3 y_3 + \ldots$$

in which again a represents the percentages by weight of the oxides, y the corresponding factors and R the compressibility. The values for y are:

SiO_2	1.23	PbO ..	0.48	As_2O_5..	1.0	K_2O....	0.05
B_2O_3 ...	0.9	MgO...	1.1	BaO ..	0.05	CaO ...	0.2
ZnO ...	0.6	Al_2O_3...	1.0	Na_2O...	0.02	P_2O_5 ...	0.76

d. COEFFICIENT OF ELASTICITY. Its calculation is done according to the formulae as under (b) and (c), but different values for y must be used, according to the kind of glass. The glasses are divided into three groups: A, silicate glasses, free from boric and phosphoric acids, barium oxide and magnesia; B, lead-free borosilicate glasses, free from phosphoric acid; C, borate glasses, containing lead and phosphoric acid. The values for y in the different groups are as follows:

	A	B	C
SiO_2	70	70	70
B_2O_3	..	60	25
ZnO	52	100	..
PbO	46	..	55
MgO	..	40	30
Al_2O_3	180	150	130
As_2O_5	40	40	40
BaO	..	70	30
Na_2O	61	100	70
K_2O	40	70	30
CaO	70	70	..
P_2O_5	..	..	70

e. ABSOLUTE HARDNESS[4]. Its calculation is done according to the formula as under b. The values for y are:

SiO_2 ...	3.32	Al_2O_3..	10.2	K_2O...	3.9	PbO...	1.45
B_2O_3 ..	0.75	BaO..	1.95	CaO...	—6.3		
ZnO ..	7.1	Na_2O.	—2.65	P_2O_5...	1.32		

f. SPECIFIC HEAT. It is calculated according to the formula:

$$C = \frac{a_1 c_1 + a_2 c_2 + a_3 c_3 + \ldots}{100}$$

in which a_1, a_2, a_3 . . . are the percentages of the oxides in glass and c_1, c_2, c_3 . . . their corresponding specific heat values:

SiO_2....	0.1913	MgO..	0.2439	Na_2O..	0.2674	P_2O_5..	0.1902		
B_2O_3 ...	0.2374	Al_2O_3..	0.2074	K_2O...	0.1860	Mn_2O_3	0.1661		
ZnO ...	0.1248	As_2O_5..	0.1276	Li_2O..	0.5497				
PbO ...	0.05118	BaO...	0.06728	CaO..	0.1903				

g. HEAT CONDUCTIVITY. For its calculation it is first necessary to calculate the percentages by volume of the different oxides contained in the glass. This is done according to the formula:

$$V_i = \frac{a_i}{z_i} \times \text{specific gravity.}$$

The value for the specific gravity can be calculated as in paragraph a or the experimental value can be substituted. a_i represents the percentage by weight of a component of the glass and z_i the corresponding specific gravity. The values of z_i are given in paragraph a.

If the percentages by volume are known the heat conductivity can be calculated from the formula:

$$\frac{1}{K} = v_1 y_1 + v_2 y_2 + v_3 y_3 + \ldots$$

in which K is the heat conductivity, v the percentages by volume and y are the following values:

SiO_2 ..	3.4	PbO ...	16.0	As_2O_5..	3.0	K_2O ...	13.3
B_2O_3 ..	6.6	MgO ..	5.0	BaO...	13.0	CaO ...	6.0
ZnO ..	15.0	Al_2O_3...	2.5	Na_2O...	10.5	P_2O_5 ...	6.7

h. COEFFICIENT OF THERMAL EXPANSION. Its calculation as per formula under b. Multiplied with 10^{-7} these values give the coefficient of cubical expansion. The linear expansion coefficient is obtained by dividing the cubical by 3.

The values for y are:

SiO_2 ...	0.8	MgO ...	0.1	Na_2O...	10.0	TiO_2 ...	4.1
B_2O_3 ...	0.1	Al_2O_3 ...	5.0	K_2O ...	8.5	MnO...	2.2
ZnO ...	1.8	As_2O_5 ...	2.0	CaO ...	5.0	Fe_2O_3 ..	4.0
PbO ...	4.2	BaO ...	3.0	P_2O_5 ...	2.0	CuO ...	2.2

g. COEFFICIENT OF THERMAL RESISTANCE.

$$F = \frac{P}{\alpha E} \sqrt{\frac{K}{S C}}$$

in which

P = tensile strength.
α = coefficient of elasticity.
E = coefficient of elasticity.
S = specific gravity.
C = specific heat of the glass.

For the calculation of F the values, calculated from the chemical composition by the foregoing methods should be substituted.

(To be continued)

[4] In the vernacular of the glass house "hard" glass means glass which is difficult to melt. A batch is "harder" or "softer" according to whether it melts at a higher or lower temperature. In a physical sense hardness means resistance against mechanical forces, for instance against abrasion during grinding. In this paragraph the latter hardness is meant.

The Glass Industry

The First Technical Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials, and Glass Factory Equipment and Operation.

Published Monthly by the
GLASS INDUSTRY PUBLISHING COMPANY, INC.
50 Church Street, NEW YORK

Telephones { Cortlandt 2465 / Cortlandt 5618 — Cable Address, Glasdustry

J. B. KRAK, Technical Editor

Subscription Price.....$2.00 a Year
Single Copy.....20 Cents

THE GLASS INDUSTRY circulates extensively among American and foreign glass manufacturers, their business executives and technical and factory operating staffs.

ADVERTISING RATES SENT ON REQUEST

Vol. 4 NEW YORK, SEPTEMBER, 1923 No. 9

CONTENTS

	Page
Initial Heat Lehrs	163
Glass Grinding Fixtures	166
Recuperation and Heat Recovery (Part I)	167
Electrification of the Allegheny Plate Glass Company	169
The Testing of Glass for Practical Use (Part I)	172
Editorial:	
Factory Surroundings	174
Unusual Examples of Stones in Glass	174
Corporations Should Support the American Ceramic Society	175
Technical Consultation Service:	
Rock Crystal Glass	175
Correspondence	175
Recent Patents	176
Glass Factory Equipment and Supplies:	
A Large Bergman Automatic Reversing Valve	178
A. B. Knight Brings Out New Machines	178
New Books	178
The Glass World and What It Is Doing:	
Ceramists' Meeting a Notable Success	179
Ceramic Society at Chemical Exposition	179
British Glass Technologists Visit France	179
Production of Beer Bottles in Japan	180
New Glass Door Knob Factory	180
Verified News of Trade Activities	180
Personal Items	181
Recent Deaths	181
Inquiries Received	181
Stock Quotations	181
Current Prices of Glass-Making Materials	182
Monthly Summary of United States Foreign Commerce in Glass	182

CLASSIFIED BUYERS' GUIDE, PAGE 16

"The Better is the enemy of the Good."

Factory Surroundings

On the shores of the Monongahela, the River of the Falling Banks of the Indians, there is a charming hillside, which in the Summer time is covered with flowers of all description. When rains are abundant there flows a little brook down the grass-covered slope towards the mighty river. This garden is not part of a millionaire's estate. It is the gate through which workmen pass daily on their way to work in a glass factory. Somehow, in some way, the spirit of this garden pervades the organization and is reflected in the faces of executives and workmen.

There is no denying the fact that with the introduction of machinery the glass industry has lost much of its romance. And with it, the glass workers have lost much of that pride in their skill and achievements, which has sustained the sturdy race of glass blowers from antiquity, and which has made this craft perhaps the most picturesque of all industries.

There is no use bemoaning these facts. We could not, if we would, oppose the victorious march of that marvelous product of the human brain, the machine. It does not help if some, like Canute, king of the Norsemen, order the waves to recede. But far-seeing executives recognize that there must be compensation in kind for a loss which is more spiritual than material.

As a result of machinery, the introduction of standardization has become inevitable. Standardization of the product in all its details. Standardization even of the movements of the attendants of the machine. But in doing so there is the danger of introducing an intolerable dullness, which depresses workers to such an extent as to minimize favorable results obtained. It is here, that some serious mistakes have been made. Efficiency experts, working along mechanical lines have failed to perceive that human beings require different methods. Only those have succeeded who were willing to forget their dogmas and enter this new field of what might be termed "human engineering," with a free and open mind.

What results can be obtained in this line may be seen in the success of some, usually smaller organizations, often no better equipped than their competitors, but who are officered by men, not only of brains and money, but of character also.

Medical aid, welfare work, good factory buildings, hygienic working conditions, pure air, they are all investments which pay and pay well. The surroundings of many glass plants with their cullet piles, heaps of old and broken machinery and rubbish of all description are far from attractive. If instead of sordid environs a touch of beauty can be added there is sure to be a compensation reaching far beyond the bank accounts of stockholders.

Unusual Examples of Stones in Glass

The Bureau of Standards is continuing its investigation into the nature and causes of the formation of stones in glass and desires to obtain unusual examples of their occurrence. Plenty of samples of the frequently occurring types are available but glass men who come across any extraordinary types are requested to forward them to Arthur E. Williams, Glass Division, Bureau of Standards, Washington, D. C.

Corporations Should Support the American Ceramic Society

By F. C. FLINT*

Chairman of Membership Committee, Glass Division

Why is your company not a corporation member of the American Ceramic Society?

There are 23 corporations which are subscribing in support of the society and credited to the Glass Division. Fifteen of these 23 are also paying one or more personal subscriptions. The Corning Glass Works is paying the personal subscriptions for 7; Bausch and Lomb for 3; the Hazel-Atlas for 4; Macbeth-Evans for 6; Illinois Glass for 8; Mississippi Glass for 7, and Pittsburgh Plate Glass for 13 persons, in addition to their corporation subscriptions.

The financial budget for this year calls for the collection and expenditure of $40,000. Only $8,900 of this is used for salaries and clerical assistance. Three thousand is for secretary's office expense, covering stationery, postage and other materials used in promotional work.

The 1923 budget:

Journal	$22,900.00
Secretary's office expense	3,000.00
Divisions	1,200.00
Salaries	8,900.00
Committees	500.00
Traveling	1,200.00
Meetings	1,500.00
Miscellaneous and depreciation	800.00
	$40,000.00

Cost of operating the society for the first six months, including the annual convention expenses and the very expensive anniversary number of the *Journal* issued in January, totals $19,174.96, whereas the budget provides for $20,000. The society is solvent, having paid all bills to date, and on July 10 had the following assets, besides inventory of *Transactions, Journals,* office equipment, etc.:

Cash in Bank	$2,341.10
Sec. Revolving Fund	300.00
Liberty Bonds	4,700.00
Accounts Receivable	5,078.94
	$12,420.04

Considering the very excellent *Journal* which the society issues each month, I believe it can be said that the society is very economically managed.

Publishers say that the *Journal* carries too much reading matter; so much that the members really do not appreciate the fact that each number contains about 90 pages of original researches; 25 to 40 pages of abstracts; and about 50 pages of the bulletin, covering discussions and notes. The very best paper and the most expensive typesetting (monotype) is used. Altogether the society issues one of the snappiest and best printed *Journals* of its kind.

Perhaps you did not notice that within the last 12 months the amount of printed matter on each page of the *Journal* has been increased 26 per cent by widening the column from 4 to 4½ and lengthening it from 6¼ to 7 inches. At the same time, the number of pages was increased from about 90 to about 170 per issue.

The several service committees are preparing for very constructive work, evidences of some of which you already have seen in the *Journal* and will from time to time be made familiar with. Broadly speaking, the several committees are functioning as well as could be expected with the limited financial resources which the society can furnish.

You have seen the membership curve in the August number of the *Journal,* showing that the acquisition of new members is steadily going on. This year they are subtracting each month the resignations and deaths and reporting only the net number of members on the roster.

There must be some very good reason for 1,830 persons and 244 corporations subscribing to the work of the American Ceramic Society. There is much of value for each type of ceramic manufacturing in the researches conducted by the others. There being so much in common, it is quite essential if there is to be a substantial advance in ceramic knowledge and facilities that there be one central organization common to all with sufficient strength to carry on the very large and expensive work which present industrial conditions demand.

It seems to me that corporation managers would take pride in their companies being supporters of this essential enterprise.

*Chief Chemist, Hazel-Atlas Glass Company.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions are invited to submit them.

Questions should be submitted in writing and will be answered by mail as promptly as possible. The sources of all inquiries will be held in strict confidence.

Question 52.—(From Mexico.)—As a subscriber I take the liberty of asking for information regarding the manufacture of glass. I have rock crystal material enough to supply a small factory I am interested in building up. What batch do you think would be proper to use with the material which analyzes as follows:

SiO_2	93.6 per cent
Al_2O_3, Fe_2O_3	2.0 " "
CaO	1.0 " "
MgO	0.9 " "
H_2O	0.6 " "
K_2O	1.6 " "

Is it possible to make Bohemian crystal? I am told that Bohemian people use only rock crystal in making their goods, which it is well known are very much appreciated. I intend to make small crystal goods for perfumery.

Answer.—It is impossible to say whether the rock crystal can be used for the manufacture of crystal goods, since the analysis does not show separately the amount of iron it contains. This is the most important item in judging the quality of any material going into glass. If the iron content is about 0.03 to 0.04 per cent, and if you can obtain soda ash, potash, and lead oxide of great purity, there is no reason why you could not make crystal ware with this material.

The following is a batch for crystal glass:

Rock crystal	100 parts
Potash	17 "
Soda ash	12 "
Borax	10 "
Red lead oxide	35 "
Saltpeter	3½ "
Cullet (broken glass)	40 "
Manganese	¼ "

—J. B. K.

Correspondence

To the Editor of THE GLASS INDUSTRY:

I notice in the August issue of your journal—just at hand—an exceedingly inaccurate account* of the invention of the vacuum bottle, or "Dewar Flask."

The writer was in touch with Professor Dewar in 1880, and from that time onward was more or less intimately conversant with his work.

The flask was devised at about that date in connection with researches on the liquefaction of gases (for which the name of Sir James Dewar will always remain famous) to enable him to manipulate with liquids at extremely low temperatures, and it has been in constant use in this and in other countries where work on low temperature liquids has been carried on, ever since.

Its application to domestic and medical uses was obvious from the first, and it was made popular by the commercial application of the principle by German manufacturers, although it is now largely produced here, in U. S. A. and in other countries.

JAMES H. GARDINER, Managing Director,
JAMES POWELL & SONS (WHITEFRIARS), LTD.
Wealdstone, England.

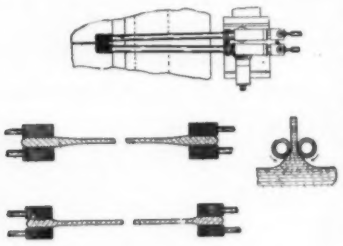
*"Vacuum Bottle a Laboratory Invention," reprinted from *Printers Ink,* on page 147, August issue.—EDITOR.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

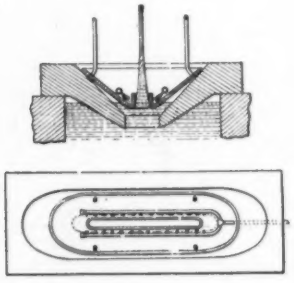
Copies of United States Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

Method of and Apparatus for Drawing Sheet Glass. U. S. 1,460,582. July 3, 1923. Seth B. Henshaw, of Charleston, W. Va., assignor to Libbey-Owens Sheet Glass Co., Toledo, O.



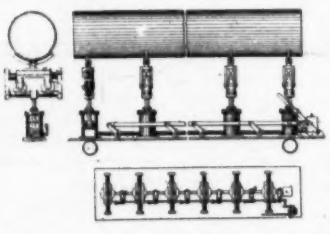
The inventor states that he has produced very successful results by driving the edge rolls at only one-fourth of the speed of the drawn sheet, that is, drawing the sheet three times faster than the peripheral speed of the edge rolls. The edge rolls should be driven at not to exceed one-half of the speed of the sheet proper—and preferably as low as one-third or one-fourth of the speed of the sheet. The effect of this very greatly reduced speed for the edge rolls practically eliminates the one to three inches of waste at the edges between the edge rolls and the main body of the sheet, and thus saves from two to six inches of glass that, in the Colburn process and apparatus, was cut off and made into cullet.

Drawing Glass Sheets. U. S. 1,463,582. July 31, 1923. Halbert K. Hitchcock of Pittsburgh, Pa., assignor of one-half to Hitchcock Experiment Co. of New Jersey.



This invention comprises a glass drawing apparatus employing a glass bath from which a sheet of glass is to be drawn, a refractory member provided with a drawing slot lying in the bath, a metal die member having a slot portion lying in the bath above the slot in the refractory member, but spaced away from the refractory member to provide a space for a body of chilled glass intermediate the refractory member and the die member, and means for cooling the die member to chill the said body of glass lying beneath such die member and prevent adherence of the glass to the surface of the die member over which the sides of the glass sheet is drawn.

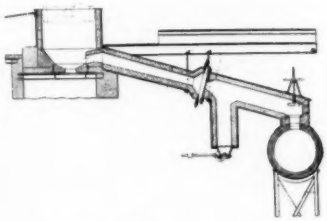
Apparatus for Supporting Glass Cylinders. U. S. 1,460,043. June 26, 1923. Thomas Stenhouse, of Washington, Pennsylvania, assignor, by direct and mesne assignments, of sixteen and two-thirds per cent to Alexander L. Duval D'Adrian, of Washington, Pa., and sixteen and two-thirds per cent to Bernhard F. Drakenfeld, Jr., of New York, N. Y.



When glass is drawn in the form of a cylinder and has been horizontally supported upon a series of spaced supporting units, it frequently happens that the cylinder is not of uniform diameter throughout its length, or at different places may be laterally bent or curved. In such instances, only a few of the supporting units in the series will bear the whole weight of the cylinder, while the others will not contact therewith. In cases where the cylinder is curved to such an extent as to place a portion of the cylinder under considerable strain when engaged on the supports, the cylinder will break, and fly into numerous pieces. It is the primary purpose of this invention to provide a method and apparatus for the support of glass cylinders whereby the objections above referred to may be wholly obviated. To this end, the inventor utilizes a non-compressible medium for exerting a sustaining influence upon the cylinder at spaced points, and distributes this sustaining influence throughout the length of the cylinder, so as to compensate for inequalities in the surface, or variations in the diameter, or curvature of different parts of the cylinder.

Burner for Furnaces. U. S. 1,460,947. July 3, 1923. Henry F. Clark, of Oakmont, Pa., assignor to Window Glass Machine Company of Pittsburgh, Pa.

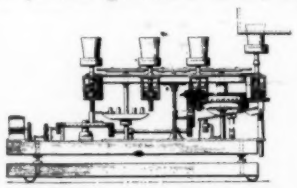
This invention relates to burners for furnaces, and is particularly useful with glass pot furnaces used in drawing glass, but it of course may be used with other heating devices. The burner is applicable to such devices when it is desired to use raw producer gas.



The object claimed by the inventor is a simple arrangement for use in burning raw producer gas, and such a device which will be kept clean notwithstanding the presence of considerable quantities of heavy hydrocarbons.

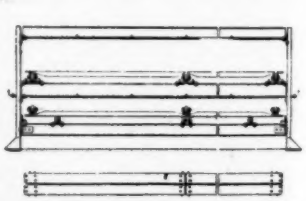
Glass Finishing and Polishing Machine. U. S. 1,462,522. July 24, 1923. Grover Cleveland Scott, Watson, W. Va.

This invention relates to a machine for smoothing the edges of pressed glassware in the nature of drinking glasses or tumblers as well as polishing the external surface thereof and includes an intermittently moving carrier, a plurality of independently rotatable glass holders supported by and movable with the carrier, a table on which the carrier operates, means for moving the carrier, means with which the holders are shiftable into and out of engagement for rotating the holders and a polishing head mounted to oscillate on the table and disposed in the path of movement of the holders to engage the latter while they are in rotation, said polishing head having a concave glass engaging surface and having outstanding arms, and a spring controlling oscillation of the head engaging one of said arms.



Lehr Conveyor. U. S. 1,462,427. July 17, 1923. Walter R. Sterrett, Carnegie, Pa., assignor to H. L. Dixon Co.

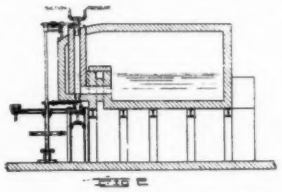
Heretofore considerable difficulty has been experienced in the operation of wide lehrs. In such lehrs the conveyor pans tend to sag greatly at the middle portions thereof, and it has been difficult to provide a satisfactory support at such portions. This invention is designed to overcome these difficulties by providing a conveyor in which the pans are formed in two or more separate sections transversely, these sections being connected to the carrying and



supporting chains in a manner which will permit of horizontal and vertical movements of the pans relative to the chains.

Apparatus for the Manufacture of Glassware. U. S. 1,461,416. July 10, 1923. Phillip Ebeling, Bellaire, O.

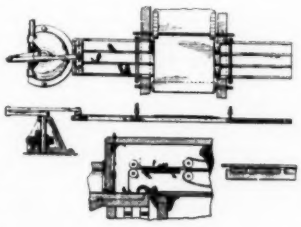
This invention has for its primary object to provide a glass melting tank having a fire-polishing chamber located adjacent thereto and receiving heat directly therefrom, whereby heat employed in melting the glass is also utilized for fire-polishing ware.



A further object of the invention is to provide, in association with a glass melting tank, mechanisms whereby molten glass from the tank is supplied to ware-forming molds, the glass so supplied is pressed into shape in such molds, and the ware so formed is finally subjected to fire-polishing blasts, said mechanism being wholly automatic in that human intervention is required only to effect transfer of the ware to the annealing lehr following the fire-polishing operation.

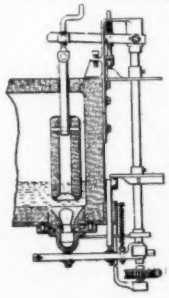
Sheet Glass Drawing Machine. U. S. 1,462,495. July 24, 1923. Thos. S. Owens, Toledo, O.

Among other features the inventor claims in a sheet glass drawing mechanism, the combination with a bending roll over which the glass is drawn in sheet form, of a flattening device disposed to act on a surface of the glass after it passes the bending roll, said flattening device comprising a guide table extending transversely of the sheet in spaced relation thereto and extending at its ends beyond the side edges of the sheet, flattening members mounted on the table for movements lengthwise thereof transversely of the sheet and in contact with the sheet, means for reciprocating the members lengthwise of the guide table, and means for applying a cooling fluid to the sheet coacting surface of the flattening members with the opposite edges of the sheet.



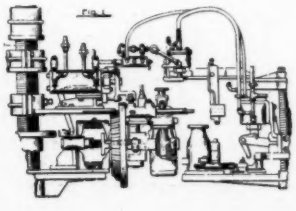
Process and Apparatus for Feeding Glass. U. S. 1,462,491. July 24, 1923. Wm. J. Miller, Swissvale, Pa.

This invention provides in the feeding of glass, for use in connection with a container for molten glass provided with a discharge orifice, the combination of means intermittently operative for detaching the glass protruding from said orifice to form gathers, a receptacle adapted to contain a quantity of liquid, means for applying said receptacle to the outer end of said orifice between detaching operations whereupon said liquid is gasified by the heat, causing the glass to be temporarily retracted along said orifice for the purposes described, and an absorbent lining for said receptacle to prevent the premature evaporation of said liquid.

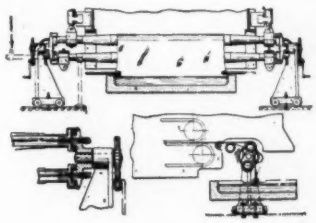


Glass Handling Apparatus. U. S. 1,462,652. July 24, 1923. Frank O'Neill, Toledo, O.

This invention has utility when incorporated as a power actuated transfer device between the blank and blow tables of glass bottle automatic machines for forming and blowing such ware, together with features of positively orienting the blank. The inventor claims a glassware manufacturing apparatus comprising traveling sectional molds, driving means to bring a pair of molds into opposing relation open toward each other, and means carried with one of the molds providing a guide toward the other mold, one of said open molds having a pair of ware engaging shiftable members mounted on the guide means for engaging an article in one mold, shifting said article out of said mold by travel of the members along the guide means and member coacting means releasing the article into the other mold by opening of the members.



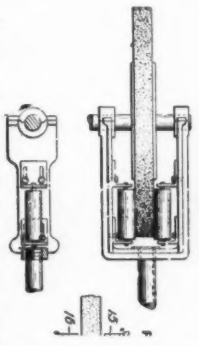
Changing Bending Rollers in Sheet Glass Drawing Machines. U. S. 1,463,251. July 31, 1923. Robert P. Callard, Charleston, W. Va., assignor to the Libbey-Owens Sheet Glass Co., Toledo, O.



A method of substituting a new bending roller in a glass drawing apparatus without halting the drawing operation, consisting in positioning the new roller parallel to the old one but out of contact with the glass sheet, revolving the two rolls simultaneously through 180° about a common center so that their positions become interchanged, and then removing the old roller.

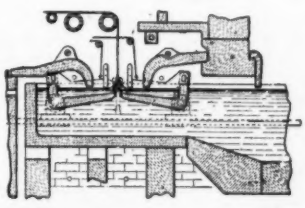
Beveled-Glass Polishing Machine. U. S. 1,462,303. July 17, 1923. Benj. Rehm, Crystal City, Mo., assignor to Pittsburgh Plate Glass Co.

The attachment comprises a pair of rollers mounted on opposite sides of the polishing disc and carried in brackets. These rollers extended out past the edge of the disc and during the polishing operation serve to prevent any spreading of the polishing wheel. Very considerable pressure is applied to the wheel in order to give the necessary polishing friction upon the beveled portion of the glass, and this pressure soon spreads out the polishing disc so that it is unsuitable for use. The rolls bring the felt back to its normal position and the felt may be worn out without widening or spreading and its efficiency may be maintained until it is completely worn down to the clamping plates.



Drawing Continuous Sheet Glass. U. S. 1,463,273. July 31, 1923. Leonard D. Soubier, Toledo, O., assignor, by mesne assignments, to the Libbey-Owens Sheet Glass Co., Toledo, O.

A pair of opposing pivoted partition members, forming substantially the two halves of a shallow pot or receptacle, are mounted within the molten glass adjacent the upper surface thereof. These members may be tilted or swung about their pivots and also moved bodily toward or from one another by means accessible from outside the apparatus, and in this way the effective depth of the draw-pot is adjusted. The supply of glass to the interior of this shallow pot flows up through the slot or passage between the opposing pivoted members, directly beneath the line of draw of the sheet, thus insuring an even and equal feed to the sheet from both sides thereof. At the same time the width or area of the slot or passage may be varied by adjusting the members about their pivots, or moving them toward or from one another.

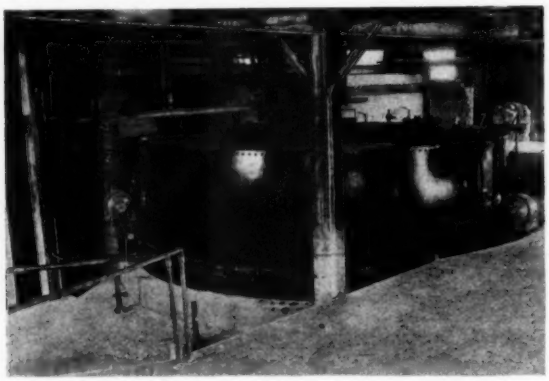


Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

A Large Bergman Automatic Reversing Valve

The latest and largest installation yet made of a Bergman automatic reversing valve is here shown as it appears in successful operation at the factory of the Licking Window Glass Co., Utica, O. The construction and operation of this valve was



BERGMAN VALVE IN OPERATION AT LICKING WINDOW GLASS CO.

described and illustrated in THE GLASS INDUSTRY, November, 1920, shortly after the patent application was filed. It is the invention of Wm. G. Bergman, of McCamic-Batchell-Bergman Co., glasshouse engineers and contractors, Toledo, O.

from below, but it is preferably entered from above through brick-lined steel flues.

The valve can be set up on old, as well as new, installations. It can be operated automatically by a time clock, thermostat, push button, or in an emergency, by hand.

A. B. Knight Brings Out New Machines

Facts of interest to glassware manufacturers are given by A. B. Knight, the well-known manufacturer of etching, glazing, grinding, and cutting-off machinery for tumblers and stemware, in his announcement on another page of this issue that he has developed important improvements and additions to his line and placed them on the market. The principal item is a system of machinery for completely finishing all kinds of tumblers and stemware without handling the ware in trays, the only exception being the bringing of the ware up to the cracking-off machine. The ware is gradually warmed-up before it reaches the melting burner and gradually cooled off after it passes the burner, eliminating wringing-off operations. The new glazing machine employed in this system can be used separately as a substitute for the ordinary round machine now in general use.

A machine of new design for glazing and polishing pressed tumblers can be made of any capacity and length and delivers the ware right up to the lehr from the automatic presses. A new motor-driven lathe for cutting glassware is another innovation.

Mr. Knight, whose inventions are in daily use in many glass factories throughout the country and abroad, claims that his new system for completely finishing glassware is the greatest improvement along this line in a hundred years.

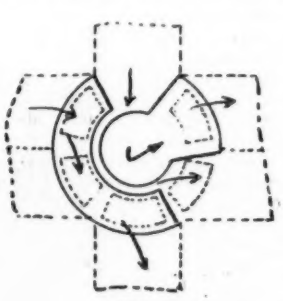


FIG. 1

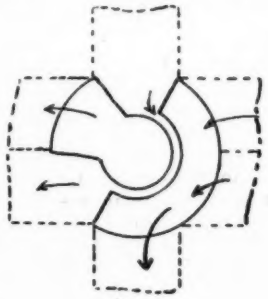


FIG. 2

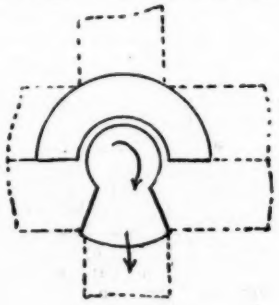


FIG. 3

The diagrams above show clearly how a single hood at one operation reverses gas, air, and waste gas at the same time. The valve is constructed with a number of chambers which communicate with subterranean passageways leading to and from the sources of gas and air supply and the furnace and stack. The position of the valve with reference to the passageways determines the direction of the flow of air and gas. By rotating the valve 120 degrees, as shown in Figs. 1 and 2, the flow is reversed.

The valve takes care also of burning-out, in which case its position is as shown in Fig. 3, where the source of gas supply is connected directly to the stack.

The makers of this valve describe it as having all constrictions in the passageways for air, gas, and waste gas eliminated and no movable parts inside the valve. The gas, air, and waste gas are watersealed, eliminating leakage and assuring high efficiency. During the burn-out proceedings the stack is not connected with the furnace which therefore lies absolutely dormant. Danger of accidents is greatly reduced because of the air and gases being all reversed at the same time. The valve is lined with a light refractory insulating material to resist abnormal temperatures. When local conditions demand it the raw gas may enter the valve

New Book

A TEXT BOOK FOR SALESPEOPLE ENGAGED IN THE RETAIL SECTION OF THE POTTERY AND GLASS TRADES. Scott, Greenwood & Son, *The Pottery Gazette and Glass Trade Review* offices, 8 Broadway, Ludgate, London, E. C. Sale in the United States by D. von Nostrand & Co., 8 Warren street, New York, 1923, xii+87 pp. 65 illustrations. 8½x5¼ inches.

This little book is "compiled by experts in conjunction with the education committee of the pottery and glass trades benevolent institution, for the guidance of their members in connection with the institution's examinations." It contains a concise description of the principles and the art of pottery and glass manufacturing. The aim of this volume is to impart to salespeople the necessary technical information required to give them a thorough understanding of the ware which they are to sell. The subject matter is treated in a manner which enables beginners to grasp the essentials without great effort. The volume should be of great use to all interested in glass and pottery.

The Glass World and What It Is Doing

News of the Industry

Ceramists' Meeting a Notable Success

The morning of Wednesday, August 8, found a large party of members and guests of the American Ceramic Society assembled at the Hotel Secor, Toledo, O., expectantly awaiting the opening events of the Summer meeting. A program based on a series of visits to ceramic and other plants in Toledo, Detroit and Flint, Mich., had been prepared and proved quite adequate to keep the members actively and profitably employed for the remainder of the week.

The first day's tour at Toledo, which has become a great glass center, included visits to the large works of the Owens Bottle Co., where the famous automatic bottle machines were seen in operation; the Buckeye Glass Co., where O'Neill glass blowing machines and feeders were producing bottles and jars in large quantities; the Buckeye Clay Pot Co., where the visitors had an opportunity of observing modern methods and up-to-date equipment for producing glass pots of different types, tank blocks and other refractories.

A complimentary luncheon was enjoyed at the Toledo Yacht Club and in the afternoon many of the members went by boat to Detroit. Some, however, remained behind and made a trip to the Edward Ford Plate Glass Company's plant where the various operations in making plate glass by standard methods were studied with interest. By Thursday morning the party had reassembled in Detroit and a trip was taken to the Ford Motor Company's plant at Highland Park, where Ford theories of automobile production were visualized for the visitors who witnessed the assembling of motor cars at almost unbelievable speed. The main point of interest, however, for the ceramists, was the Highland Park glass plant, where the continuous process to be employed at the new Ford plant now being erected at River Rouge, near Detroit, was worked out by the company's engineering staff.

[An extended description of this process and illustrations of the glass-making equipment of the Highland Park factory were published as the leading article in the January, 1923, issue of THE GLASS INDUSTRY, and particulars given of the proposed larger plant at River Rouge, which is now partly completed.]

Another Thursday morning visit was that made to the Champion Porcelain Company, where much of value to those interested in porcelain enameling was to be seen. A complimentary luncheon was served by the company, after which members in several separate parties visited various plants in Detroit or spent the afternoon "seeing the sights" of this great industrial center. On Friday a large party went by electric railway to Flint, Mich., and inspected the factories of the A. C. Spark Plug Co. and the Buick Motor Co. That evening a dinner was held at the Hotel Wolverine, Detroit.

On Saturday the main objective was the new plate glass plant of the Ford Motor Co. at River Rouge. This plant will put the continuous process developed at Highland Park into operation on a large scale and will comprise four melting tanks and continuous lehrs, the first of which has been completed by the contractor, H. L. Dixon Co., Pittsburgh, Pa.

On Saturday afternoon the party broke up after having thoroughly enjoyed a most pleasant and instructive trip. Many expressions were heard during the week of appreciation for the splendid work of Secretary Ross C. Purdy and the committees in charge of activities at Toledo, Detroit, and Flint, and special credit given to the manufacturers who generously opened their plants to inspection and entertained the members.

Correction

In the description of the J. E. Marsden Glass Works, Ambler, Pa., which appeared in the August issue of THE GLASS INDUSTRY reference was made to the Lalor fuel oil system in operation at that plant and it was stated that with the Lalor system "oil is used under 300 pounds pressure with air at 8 to 9 ounce pressure." This should read "oil is used at 300 pounds pressure and air at 1½ ounces at the burner." This means a great reduction in the horsepower and gives a slow lazy flame which all engineers try to get in their furnaces. The heat does better work and it is better distributed throughout the furnace.

Ceramic Society at Chemical Exposition

The National Exposition of Chemical Industries to be held at the Grand Central Palace, New York, during the week of September 17, will be the last exposition until 1925, 60 per cent of the exhibitors having voted for biennial expositions hereafter. As usual, this year the American Ceramic Society will meet in conjunction with the exposition, Wednesday, September 19 having been designated Ceramic Day. An interesting and profitable program of discussions for that afternoon has been prepared. A dinner at Hotel Commodore at 7 p. m. has been arranged.

In connection with a new feature of the exposition—a course in the practical business side of chemical engineering for university students—about 30 authorities in different chemical fields will discuss their specialties for the benefit of the students. A few of the subjects to be discussed are: Handling of Materials, by A. E. Marshall, Baltimore, Md.; Ceramic Materials: Clay, Glass, Silica and Enameled Ware, by Ross C. Purdy, secretary, American Ceramic Society; Glass Enameled Steel Products as Materials of Construction, by O. I. Chormann, Pfaudler Company, Rochester, N. Y.; Furnace Wall Construction, by W. H. Gaylord, Quigley Furnace Specialties Company, New York.

British Glass Technologists Visit France

A party of about thirty members of the Society of Glass Technology recently made a tour of several glass factories in France, inspecting equipment, investigating methods, and discussing problems of the industry with the French glass manufacturers they met. The start was made from London on June 30, with Paris as the first objective. Arrived there, the party was met and welcomed by M. Delloye, director-general of the great glassworks of St. Gobain, Chauny and Cirey. The following Monday a reception was given them by the French Syndicate of Glass Manufacturers, of which M. Houdaille is president.

M. Houdaille addressed the visitors at some length, welcoming them heartily to France, thanking them for what the Society of Glass Technology had done for the glass industry in general, and then touched upon the effects on the French industry of the destruction wrought on glass factories by the Germans during the war. Prof. Turner replied, expressing the hope that the visit of the English party would result in an exchange of experiences between visitors and hosts that would help each in the solving of their glass-making problems. One speaker brought out the fact that English manufacturers of glass, as well as other products, were experiencing great difficulty in obtaining sufficient orders to keep in operation the large extensions made to their factories during the war, and that unemployment in England had again become a serious problem. International conditions and markets were discussed by M. Delloye, who advocated the adoption of some definite arrangement between competitors in various countries to prevent the calamitous effects which might result from unrestricted and unintelligent competition, and cited an instance where it had become impossible, apparently, some years ago, to avert a crisis in the plate glass industry. Millions of francs were being lost through over-production. Conferences took place and a clearing house was set up in Brussels where production statistics for all European plate glass factories, except the English, were filed. This disclosed the fact that

twice as much glass was being made as could be sold. It was decided to limit production and prices were regulated. The result was the saving of an industry that had been slowly committing suicide and a better condition of affairs than could possibly have resulted had over-production continued to the point of causing a collapse. When each individual country increased its production facilities without being in full possession of information as to what others were doing, there would always be dangerous situations arising.

Following the reception, a banquet at the Continental Hotel, provided by the glass manufacturers, was enjoyed by the guests, who then adjourned to the meeting hall of the Society of Civil Engineers where several papers of a technical nature were read. On Tuesday morning visits were made to the National Porcelain factory at Sèvres and to the glassworks of Etablissement Legras, at St. Denis, where several hundred workmen are employed. On the following day the party inspected the factory of Charbonneaux et Cie., whose entire capacity is devoted to the manufacture of champagne bottles. A visit to the famous champagne cellars of this district was also made. On Thursday the party went to Fontainebleau, famous historically and for the high quality of the glass sand produced in the vicinity. On Friday, the last day of the tour, visits were made to the new and modernly equipped plate glass factory at Chanteraine and the famous glassworks of St. Gobain, after which the party returned to Paris and disbanded. The tour proved to be an unqualified success. The many courtesies extended to the visitors and the cordial attentions of their hosts were highly appreciated by all who took part in the tour.

Production of Beer Bottles in Japan

Beer bottles are in great demand in Japan. Dainippon Beer Co., is increasing its capacity to 400,000 a day by means of the newly equipped Suita Works at Osaka. The former capacity was 250,000 pieces per day. It is reported that there was great depression in Japan this year in foreign business as exports of beer fell below last year and manufacturers were compelled to find a market inland.

The productive capacity of beer bottles per year of various companies is as follows:

Dainippon Beer Co.:	
Suita Works	1,400,000 cases
Supporo Works	350,000 cases
Hakata Works	50,000 cases
Dairi Works	350,000 cases
Chintao Works	100,000 cases
Hodokaya Works	1,250,000 cases
Total	3,500,000 cases
Kirin Beer Co.:	
Yokohama Works	400,000 cases
Kansaki Works	400,000 cases
Total	800,000 cases
Sakura Beer Co.	350,000 cases
Kabuto Beer Co.	350,000 cases
Tokyo Brewing Co.	50,000 cases
Anglo-Japanese Brewing Co.	50,000 cases
Grand total	5,100,000 cases

NOTE: One case contains 4 dozen.

New Glass Door Knob Factory

The Technical Glass Company, Inc., Los Angeles, Cal., which is reported to have developed a business of $300,000 in glass door knobs and drawer-pulls during the past year, has begun the construction of a new factory 75 by 160 feet, on East 48th street. The plant will be of modern steel, brick, terra cotta and glass construction. Quick completion being essential the company awarded the building contract to the Austin Company of California, who contracted to finish the work in 60 days at a cost of $25,000. Manufacturing operations will begin in October.

The new plant will have double the capacity of the present factory which will be abandoned after the new one is in operation. The company has developed a local deposit of silica sand which will make it independent of the Belgian sand imported as ballast and used by most of the California glass manufacturers. The company's business has developed from small beginnings in 1920, when only six men were employed, to its present proportions, with a capital of $100,000 and 90 employees. M. H. Rosenthal is president; M. B. Schutz, vice-president and treasurer, and W. A. Anderson, secretary and production manager.

Coming Meetings

The National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York, December 3 to 8, 1923.

The Fall meeting of the Eastern Glass Distributors' Association will be held at New York, September 25 to 27.

The next annual meeting of the American Ceramic Society will be held at Atlantic City, N. J., February 4 to 6, 1924.

The next annual meeting of the National Ornamental Glass Manufacturers' Association of the United States and Canada will be held at New York, June 24 to 26, 1924.

The National Glass Distributors' Association will hold their annual meeting on December 4 and 5 at the William Penn Hotel, Pittsburgh, Pa.

The Western Glass Jobbers' Association will hold its first Fall meeting at the Congress Hotel, Chicago, Ill., on September 11 and 12.

A meeting of hand window glass plant manufacturers will be held Sept. 5 and 6 in Pittsburgh, Pa., for the purpose of considering the wage scale for the coming year.

The Ninth National Exposition of Chemical Industries will be held at the Grand Central Palace, during the week of September 17 to 22, inclusive. Wednesday, September 19, will be Ceramic Day, when a meeting of the American Ceramic Society will be held.

Verified News of Trade Activities

T. H. Bedell has been appointed receiver of the Therasse Glass Corporation, Marion, Ind.

Wm. B. Keefer has been appointed permanent receiver of the Spring City Glass Co., Spring City, Pa.

The **Model Window Glass Co.,** Fort Smith, Ark., was destroyed by fire August 17 with a loss, according to the press, of $225,000. Immediate rebuilding is expected.

Willson Goggles, Inc., Reading, Pa., are reported to be planning a new plant to be erected near their present factory and to cost about $500,000 including equipment.

The decision to rebuild the factory of the **Wilcox Glass Co.,** Wilcox, Pa., which was recently destroyed by fire, marks the end of hand-blown window glass making in that section of the state.

The incorporation of the **George A. McKim Glass Co.,** Pittsburgh, Pa., with a capital of $200,000, is announced, the concern to handle glass products. H. S. McCune, Wilkinsburg, Pa., is treasurer and representative.

Press reports announce a proposed consolidation of the **Jefferson Company** and the **Jefferson Glass Company,** Follansbee, W. Va., of which C. H. Blumenauer is president and treasurer. Additional equipment will be installed.

Plans for the new factory of the **Pennsylvania Wire Glass** Co., at Lewistown, Pa., which will be used for the manufacture of the company's products, are not entirely completed, but it is reported that they will include the largest "all glass" building in the country.

Application has been made for a Pennsylvania charter for a proposed corporation to be known as the **Superior Plate Glass Corporation,** the object of which is to engage in the manufacture of glass. Patterson, Crawford, Miller & Arensberg, Pittsburgh solicitors, are representing the parties interested.

The **Lynchburg Glass Corporation,** Lynchburg, Va., has been incorporated with $300,000 capital. N. D. Eller is president, W. H. Lloyd, secretary, and J. William Gayner, formerly vice-president and general manager of the Gayner Glass Co., Salem, N. J., will occupy a similar position and title in the new concern.

Action has been taken by the stockholders of the **Washing-**

ton Glass Manufacturers, Inc., Anacortes, Wash., ratifying an agreement with the mortgagee, J. O. Jensen, formerly of Geneva, N. Y., by which the company will retain its right of redemption for a year and allow the mortgagee to improve the plant and operate it before the redemption period has elapsed.

The Southern Glass Co., Winchester, Ind., has been incorporated with $25,000 capital and has leased from the Bastrop Glass Co., Bastrop, La., who are successors to the Ouachita Valley Glass Co., the latter's plant at Bastrop. Fires were lighted July 25 and the plant is expected to be in full operation in 60 days. Ed. S. Hart, recently of Dunkirk, Ind., is general manager.

The Wilson-Maeulen Company, 385 Concord avenue, New York, announce that they have obtained the rights to manufacture and sell in the United States the Elverson Oscilloscope brought out by Herbert Kennedy & Company, Ltd., London, England. This instrument is designed for use when studying the functioning of rapidly moving mechanisms. A brief description of it was given on page 137 of THE GLASS INDUSTRY, July, 1923.

The Continental Flat Glass Company, Shreveport, La., which was recently organized to manufacture window glass, windshield glass and heavy glass by the Fourcault process, has taken over the plant of the National Glass Company, also of Shreveport. The company was capitalized at $300,000 and after extensive alterations and the installation of the Fourcault machines, it is expected that the plant will be ready for operation in the Fall and will give employment to about 160 men. The officers of the company are: Louis Mottet, president; S. J. Harman, vice-president; D. N. Skinner, secretary-treasurer.

The C. & G. Cooper Company and allied companies, **The Chapman Engineering Company** and **The Chapman-Stein Furnace Company,** are discontinuing both their New York and Pittsburgh branch offices, and are asking that all communications be addressed to the home office at Mt. Vernon, Ohio. In recent years so much of their work has involved engineering service that they find they can respond to requests for quotations and special service more quickly when these requests are sent direct to the home office at Mt. Vernon, where they maintain an extensive engineering department in connection with their manufacturing plant. The chief products of these companies are gas producers, complete producer gas plants and industrial furnaces, steam and gas engines, air and gas compressors, and special heavy machinery.

Plans for the rebuilding of the factory of the **New Cumberland Glass Co.,** New Cumberland, W. Va., which was destroyed by fire on August 13 were gotten under way the same day. Arrangements were made to take bids on a modern brick or concrete and steel building, and on three sets of lehrs. Contractors will guarantee to put the plant in full operation in sixty days to enable the company to take care of their Fall business in "Egyptian" vases and holiday novelties. Heretofore their principal product has been lamp chimneys and this line will be continued and new lines added. About 130 employees were thrown out of work by the fire. Losses were about $40,000 with $23,500 insurance. F. E. McElfresh, general manager, requests readers of THE GLASS INDUSTRY who furnish glasshouse equipment to forward catalogs immediately as all old catalogs were burned.

Personal Items

Benjamin Alderson, formerly chemist for the American Bottle Company at Streator, Ill., and since February of this year in charge as general factory foreman of the company's Newark, O., plant has been transferred to the Streator factory and promoted to be assistant plant manger.

The appointment of **S. Henry Ayers,** bacteriologist of the dairy division of the Bureau of Animal Industry, Washington, D. C., to the position of director of research of the Glass Container Association, was recently announced. Dr. Ayers has long been known in the fields of scientific research, particularly with the problems of the milk industry. A very large number of scientific publications, based upon his work, have been published by the Department of Agriculture, and through these he has made probably greater contributions to the milk industry than any other man in this country. Dr. Ayers is a comparatively young man, a graduate of the Massachusetts Institute of Technology. Many of his works have been translated into other languages, so important were they as contributions to scientific thought and practical knowledge.

Recent Deaths

W. R. Miller

W. R. Miller, president of the W. R. Miller Company, Pittsburgh, Pa., died at his home in that city on July 26. Mr. Miller, who was 73 years of age, was well known in the glass industry for many years as an engineer. He is survived by his wife, two sons and three daughters.

Inquiries Received

For further information address THE GLASS INDUSTRY

145.—One of our clients wants names of manufacturers of glass knobs.

146.—I have just completed six machines for a company which is about to put on the market a very superior mayonnaise, and they wish me to get for them a line of white glass jars, such as used for jams. Kindly send names of makers of such jars.

147.—Is automatic beveling of plate glass now being done in the United States? If so I would like to receive catalogs of manufacturers of equipment for that process, and particulars regarding the grinding wheels employed.

148. We will thank equipment manufacturers and supply houses to forward their catalogs immediately as all we had were destroyed when our factory was burned down recently. We are rebuilding to manufacture lamp chimneys, Egyptian vases and other specialties. F. E. McElfresh, general manager, New Cumberland Glass Co., New Cumberland, W. Va.

149.—(From India.) Kindly put me in communication with firms who manufacture and supply machinery for making spectacle lenses, electric lamps and glass beads.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, AUGUST 27, 1923

	Bid	Ask	Last
American Window Glass Machine Common..		84	84½
American Window Glass Machine Preferred.	89	90	90
American Window Glass Preferred.....	105		107
Pittsburgh Plate Glass.....	180	185	184
U. S. Glass.....		26	26½

A quiet market prevailed during the past month, the only issue showing any activity at all to speak of being Pittsburgh Plate Glass. American Window Glass preferred went ex-dividend 3½% during the month, which accounts for the differential between the bid price and the last sale. No announcements of importance were made during the month by any of the glass companies, but it is generally expected that the coming month will bring more activity in the glass group.

WHEELING STOCK EXCHANGE, AUGUST 27, 1923

	Bid	Ask	Last
Hazel-Atlas	39	40	39½
Imperial Glass	98	99½	99½
Fostoria Glass	138	140	140
Central Glass	90	100	90

While the market for the past month was characterized by inactivity, prices maintained a firm tone and there is little change to report in the general level of prices. The only issue showing any activity was Hazel-Atlas, but even this stock held very close to its former level, and practically all trading was accompanied by only fractional changes in price.

TOLEDO STOCK EXCHANGE, AUGUST 27, 1923

	Bid	Ask	Last
Owens Bottle Machine, common.....	44¾	45½	45
Owens Bottle Machine, preferred.....			110
Libbey-Owens Sheet Glass, common....	118	122	120
Libbey-Owens Sheet Glass, preferred...	102	105	

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers

August 25, 1923

		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.05½
Aluminum oxide (Al_2O_3)	lb.	.06½	.07
Antimony oxide (Sb_2O_3)	lb.	.07	.07½
Arsenic trioxide (dense white), 99% (As_2O_3)	lb.	.10-.11	.10½-.11½
Barium carbonate ($BaCO_3$)	ton	70.00	90.00
Barium hydrate ($Ba(OH)_2$)	lb.	.05½	.05¾
Bone ash	lb.	.07	.08
Borax ($Na_2B_4O_7\,10H_2O$)	lb.	.05½	.06
Borax, fused, any mesh ($Na_2B_4O_7$)	lb.	.19	.20
Boric acid, fused (B_2O_3)	lb.	.35	.35
Cadmium Sulphide, red (CdS)	lb.	..	1.65
Cadmium Sulphide, orange	lb.	..	1.55
Cadmium Sulphide, yellow (CdS)	lb.	..	1.65
Chrome oxide	lb.	.35	.36
Cobalt oxide, in bbls. (Co_2O_3)	lb.	..	2.10
Cobalt oxide, in 10 lb. tins (Co_2O_3)	lb.	..	2.20
Copper oxide, red	lb.	..	.15-.16
Copper oxide black (CuO)	lb.	..	.26
Copper oxide, black prep'd (CuO)	lb.	..	.30
Cryolite (Na_3AlF_6)	lb.	.09	.09½
Feldspar, 100 mesh	ton	11.50-16.00	20.00
Fluorspar, powdered white, 95% (CaF_2)	ton	48.00	60.00
Fluorspar, powdered white, 90% (CaF_2)	ton	45.00	55.00
Hydrofluoric acid (HF) 60% (in lead carboys)	lb.	.13	..
Kaolin (f.o.b. mine)	ton	10.00	20.00
Lead oxide (red lead) (Pb_3O_4)	lb.	.10⅞	.11⅜
Litharge (PbO)	lb.	.10⅜	.10⅞
Lime—			
Hydrated (in 50 lb. paper sacks) ($Ca(OH)_2$)	ton	12.50	..
Burnt, ground, in bulk (CaO)	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground in 280 lb. bbls. per bbl.		2.15	2.30
Manganese 85% (MnO_2)	lb.	.03½	.04
Nickel oxide, black (Ni_2O_3) for nickel content	lb.	.32	..
Nickel monoxide, green (NiO) for nickel content	lb.	.30	..
Potassium carbonate—			
Calcined 90% (K_2CO_3)	lb.	.06½	.07
Hydrated 90% (KOH)	lb.	.07	.07¾
Potassium nitrate (KNO_3) (gran.)	lb.	.06⅜-.06½	.06½-.06¾
Potassium Permanganate ($KMnO_4$)	lb.	..	.17
Powdered blue	lb.	..	.24-.26
Powdered blue (std. formula)	lb.	..	.38
Salt cake, glassmakers, f. o. b. works (Na_2SO_4)	ton	26.00	35.00-40.00
Selenium (Se)	lb.	..	2.10-2.85
Soda ash (Na_2CO_3) dense, 58%			
Bulk	Flat 100 lb.	1.47	..
Bulk, on contract	Flat 100 lb.	1.42	..
Sodium nitrate, refined ($NaNO_3$)	lb.	.04-.04¼	.04¼-.04½
Sodium selenite (Na_2SeO_3)	lb.	1.90	2.00-2.50
Sodium Fluosilicate (Na_2SiF_6)	lb.	.07¾	.08½
Sulphur (S) (flowers)—in bbls. per 100 lb.		3.25	3.55-3.80
Sulphur (flowers) Bags per 100 lb.		3.00	3.30-3.55
Sulphur (S) (flour, heavy), in bbls. per 100 lb.		2.50	3.00
Uranium oxide—100 lb. lots (UO_3)	lb.	..	2.25
Zinc oxide (ZnO)	lb.	.08	.08½

Monthly Summary of United States Foreign Commerce in Glass

Exports

Corrected to July 25, 1923

	June 1922 Quantity	June 1922 Value	June 1923 Quantity	June 1923 Value	Twelve Months Ending June 1922 Quantity	Twelve Months Ending June 1922 Value	Twelve Months Ending June 1923 Quantity	Twelve Months Ending June 1923 Value
Glass and glass products (total)	.....	$794,274	.....	$1,102,144	.....	$8,726,846	.....	$9,903,092
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,241	8,454	6,537	32,729	26,328	151,011	39,229	218,692
Plate glass, unsilvered, sq. ft.	309,511	134,965	210,235	96,865	2,704,644	1,192,359	2,269,176	907,118
Other window and plate glass, n. e. s. lbs.	181,744	33,634	339,955	44,322	[2]957,043	[2]111,276	3,207,249	350,411
Glass containers (bottles, vials and jars) lbs.	4,861,313	247,640	8,672,106	395,920	.....	2,386,981	62,665,959	3,108,173
Table glassware, plain lbs.	1,056,682	122,936	2,837,443	198,782	[2]4,500,754	[2]552,535	19,644,936	1,965,746
Table and other glassware, cut or engraved lbs.	28,705	10,796	44,401	19,921	.....	133,882	586,964	227,401
Glassware for lighting—								
Lamp chimneys and lantern globes lbs.	151,382	31,162	210,812	43,048	[2]704,493	[2]149,718	1,678,246	329,184
Globes and shades for lighting fixtures lbs.	145,638	39,491	125,610	38,332	[2]735,568	[2]213,843	1,524,974	440,087
Lamps and other illuminating devices, chiefly of glass lbs.	84,284	29,857	154,363	34,871	[2]592,510	[2]221,821	1,296,158	368,414
Chemical glassware lbs.	22,599	17,175	15,126	14,338	.....	173,003	206,356	145,988
Electrical glassware, except for lighting lbs.	114,547	7,775	123,777	12,087	[2]753,683	[2]76,404	2,954,321	191,779
Other glassware, n. e. s. lbs.	984,744	110,389	912,717	170,929	.....	3,364,013	9,597,285	1,650,099

[2] Jan. 1 to June 30.

Imports

Corrected to July 25, 1923

	June 1922 Quantity	June 1922 Value	June 1923 Quantity	June 1923 Value	Twelve Months Ending June 1922 Quantity	Twelve Months Ending June 1922 Value	Twelve Months Ending June 1923 Quantity	Twelve Months Ending June 1923 Value
Glass (total)	.....	$1,106,370	.....	$1,914,682	.....	$10,151,352	.....	$18,994,578
Cylinder, crown, and sheet, lbs. dut.	4,354,537	217,477	.....	.....	50,689,351	2,595,873	[1]12,319,638	[1]560,973
Unpolished, lbs. dut.	.....	.....	3,497,773	169,956	.....	.....	[2]37,363,602	[2]1,633,980
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	.....	.....	81,531	.....	.....	.....	[2]586,502
Plate glass—								
Unsilvered, sq. ft. dut.	787,526	337,045	1,804,165	1,088,528	4,977,496	2,427,365	18,988,848	10,142,277
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft. dut.	.....	.....	271,543	35,300	.....	.....	[1]1,760,773	[2]286,751
Containers—bottles, vials, etc. dut.	.....	22,837	.....	5,167	.....	339,881	.....	299,127
Table and kitchen utensils, lbs. dut.	.....	.....	16,673	6,181	.....	.....	[2]534,862	[2]192,940
Glassware, cut or decorated, lbs. dut.	.....	209,510	260,419	111,116	.....	1,773,514	.....	1,622,969
Blown glassware, n. e. s., lbs. dut.	.....	.....	512,556	103,878	.....	.....	[2]4,332,531	[2]948,214
Other glassware) free	.....	7,041	.....	.....	.....	225,804	.....	[1]44,253
Other glassware) dut.	.....	312,460	.....	313,025	.....	2,788,915	.....	2,676,592

[1]July 1 to Sept. 21. [2]Beginning Sept. 22.